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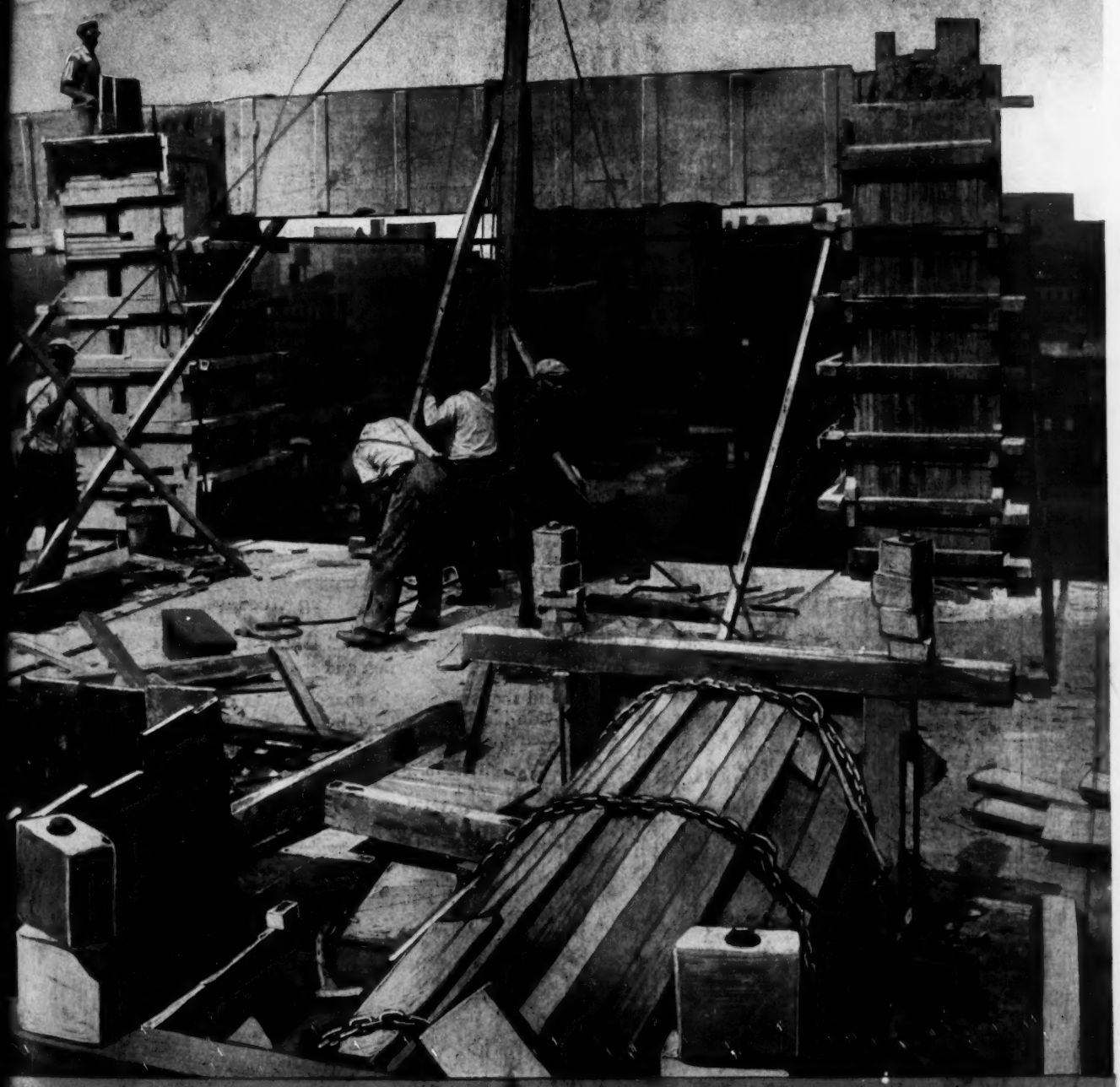

Lifting a Form for a Wall Girder into Place on Reinforced-Concrete Cold Storage Building Described in this Issue.

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Kreolite Lug Wood Blocks

"The Paving that Saves"

Pavement Between Tracks Must *Not* Buckle

and the rails must be protected from being pushed out of alignment when pavement-expansion does occur. This is the exact reason why railway companies all over this country are choosing or sanctioning the use of Kreolite Lug Wood Blocks—as the

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take care of all expansion and contraction.

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The American Society Enters the Fold

THE American Society of Civil Engineers is in its new home, in the Engineering Societies' Building, 39th St., New York. The move was made official Nov. 7 by the holding there of the regular semi-monthly meeting; and that is now the address of the secretary. Thus is consummated the most important step taken by the society in its history—one that it is hoped will go far toward unifying and strengthening the engineering profession.

Road Building Recognized by Defense Council

THE country's highways have at last been placed among the instrumentalities of defense. Last week, the Council of National Defense appointed a Highways Transport Committee. Its duty will be to determine the place of the highways in the country's transportation system, particularly as influenced by the war. The need of such a body has been vigorously emphasized in this journal for some months. Highway engineers are awake to the situation and realize that the roads have saved many an industry this year and are likely to play a larger part should serious railroad congestion result from the flood of war-materials shipments that will soon start for the seaboard. The appointment of the committee was all the more urgent because priority order No. 2, forbidding the shipment of roadbuilding materials in open cars, indicated the need for expert advice within the organization of the Council of National Defense, so that if highway building must be restricted it will be done with a full knowledge of all that is entailed. The opinions of state highway officials, on page 916 of this issue, indicate how serious is the situation created by the priority order. The appointment of the committee now places highways in their proper relation to the war activities of the nation, and highway engineers and contractors may feel assured that further action on highway matters must pass the scrutiny of a body competent to estimate the needs of highways and their place in the war scheme.

American Concrete Design Well Exemplified

THE huge new cold storage plant now approaching completion in New York City, described on page 910, is a striking example of the versatility of reinforced concrete. It was not so many years ago that designers in this country would have hesitated to use the material in such a structure. The necessary separations of columns and floors to admit the insulation would have been deemed impossible in concrete, and the wide span of the special slab near the front of the building or the high columns of the railway colonnade thought beyond the safe limits of design. Today these details, while not precisely commonplaces of design, are at least quite within the accepted possibilities of the material. With this increased application of concrete to structures, American designers have passed beyond their European teachers in the matter of simplicity. The earliest French and German reinforced-concrete experts were most daring in their conceptions and applied their new material to a variety of uses not attempted in this country for many years. But their designs were complicated in execution and in appearance. The flat slab, an American conception, has contributed no little to simplification of detail, while our racial antipathy to elaboration has worked in the same direction. The Merchants' Warehouse is a good example of what American designing skill, with emphasis on simplicity of design, can do.

Common Sense About Concrete Ships

THANKS to widespread publicity, there is today a great deal of talk about the concrete ship, despite the fact that the rosy expectations are pretty far ahead of present knowledge. One highly experimental ship of large tonnage is on the ways at San Francisco, a small, motor-driven vessel has been launched at Montreal, and several small ships have been built in Scandinavian countries. These represent the efforts of thoughtful engineers and business men to solve the tremendous problem of adapting concrete to the wracking and sudden strains of a ship at sea. Quite soon they and the committees appointed to investigate the question will be able to report the progress or the hopelessness, as the case may be, of the concrete ship. Until then the future will be veiled behind theory and experiment. For some time, however, there must be an orderly development in the size of ships experimented upon. There is no more relation between a concrete rowboat or launch and the 3000-ton, 15-knot freighter demanded in the present shipping crisis than there is between a toy airplane and a giant Caproni. Step by step up through the scow, the barge and the small framed and formed hull must progress be made to the hoped-for large vessel for ocean travel. This is the normal course of all engineering design. On account of these necessary intermediate steps, it seems as though there is at the present time a

bigger field of practical work in the concrete barge for coastwise, river or canal trade. Here the gap between present knowledge and desired results is not so great and the possibility of immediate use is much nearer. If improved design and construction make such vessels seaworthy and permanent, as many of the early ones were not, some of the most serious problems of the big ship will be solved and at the same time some very necessary bottoms supplied.

Engineering Advice Should Guide Next Season's Municipal Work

TO SAVE labor and material is the duty of cities just as much as it is the duty of individuals and of business corporations. It means that cities must save. It means that municipal construction of next season must be rigidly restricted to urgent work. Construction that can be deferred should and must be deferred. The nation demands the money, the men, and the material for making war.

Do municipal officials realize this? The record of the season just closing gives no evidence of saving except that forced by high prices and absence of bids. The rigid economy which Mr. Vanderlip, Dr. Pearson, and Mr. Hoover preached early last spring has found little or no reflection in municipal practice during 1917. But next season, it is certain beyond a doubt, this economy will be secured. It will be voluntary or forced economy, as the cities themselves elect.

Maximum economy means that all moneys spent must be used with maximum efficiency. If cities are to save by omitting work that can be deferred, they must apply fullest knowledge and wisest judgment to selecting the urgent work and separating it from the non-urgent. The country requires this of them. In a more practical way, perhaps, their bankers will require it of them, when asked for money to carry on construction; or, even the government itself may undertake to supervise local expenditures. But however necessary, any such compulsion will itself be harmful to municipal interests. The cities can secure real economy—efficient economy—only by themselves planning out their program of urgent expenditures far in advance. The time for action is now.

Engineers are needed for this work. The questions at issue in separating urgent from non-urgent work are exclusively those which the public-service engineer handles. His knowledge and his trained instinct alone can discriminate correctly—and it is important to remark that the details involved in such discrimination are intricate, technical ones. But what is actually going on in our cities is that the council and other legislative authorities are themselves, by their own lights, drawing up a program for next year's work unguided by competent engineering counsel.

An engineering commission should be appointed at once, in every city, to plan the program for next season's repair and construction work. This commission, charged with eliminating from the program all deferrable work, should be instructed to undertake its task as a pure engineering problem. Sewers, streets, water-works, transit, bridges, and all other items of municipal engineering expenditure will need to be studied in impartial manner, and the results collated and measured by an economy yardstick, before the final program can be decided on.

Here is a field for work by local engineering societies. They may in cases be able to serve when the appointment of commissions cannot be secured. They are in a position to realize the facts and to foresee what next season's exigencies will demand. They, being disinterested, can awaken the city fathers and the public to a recognition of the questions at issue and of the present moment's needs. To convince the city authorities that a clean-cut engineering problem is presented by the discrimination between urgent and non-urgent work, and that this problem must be dealt with immediately, is a task of obvious difficulty; but it is a duty.

One step was taken in this direction by the engineers of Cleveland within the last few weeks. A bond issue to be voted for at the election put the problem before them early. The local engineering society gave study to the questions involved and decided that the sewer program represented necessary construction and that the bond issue should carry. Their influence, exercised through the daily press, was undoubtedly a factor in carrying the issue.

When the bonds have to be marketed or when priority must be secured for material or labor, the verdict of the engineers that a program is in the urgent class will not fail to have weight.

Industrial Unrest and War Conditions

AS A NATION we have demonstrated our willingness and ability to back this war to the limit, financially. So much for capital.

But are we individually willing and able so to coordinate our mental and physical efforts that the vast money resources we have placed at the disposal of our Government may be used to the greatest advantage and with the maximum of economy? On the decision we make in this direction, far more than on the question of bond subscriptions, will turn the measure of our success. For the cash we have loaned is no more than an outward and visible sign—the inward and spiritual grace is externalized thereby, but we cannot rest on exhibition. It is work, hard and grim, with which we are face to face; work without the stimulus of a carefully planned campaign; harder work—and in the main, a lessened return to the majority of the population for that harder work. The nation cannot waste, as war demands, and grow prosperous unless—and here is the chance of salvation—individual productiveness is increased by an amount which will offset the temporary loss of men to the army, and the irretrievable loss of materials through the wastage of war.

England, a country much like ours industrially and idealistically, has been attempting to solve this conundrum for two and a half years. The progress made is encouraging, but so far no method has been adopted which has fully persuaded labor that its interests and those of the investing classes are identical. And unless this one point be settled now, it cannot in fairness be expected to punish itself coldly to the end that the employer alone may be benefited. But barring error in understanding or an unforgivable hesitation or lethargy on the part of the English government, the plan proposed in the Whitley report of Mar. 8, which calls for

full and recognized coöperation between employers and workmen, will transform a struggling, incoherent mass into an ordered and intelligent group, driven and directed only by its common desire to bring victory to its common banner.

Let us of America profit by this example. The reports of the work of the English committees can be found in every library—and should be on every employer's desk. The basis of their recommendations is not weakly humanitarian, but broadly and generously considerate of the rights of the investor and working man alike. Nor are the proposed schemes new in theory or practice. It will take only a little more breadth of vision than is at present the rule of the American business man to make a full application of the principles and to reap the full benefit of their inevitable working.

The American Society of Civil Engineers and the Engineer in Society

A PECULIAR and not altogether explainable change in attitude can be traced in the members of the American Society of Civil Engineers as the country is traversed from the East to the extreme West. This is particularly noticeable in the reports of the various local associations of the society on the question of their relations to the parent body, which are contained in the October issue of the *Proceedings*. Here one can find the opinions and statements of the Baltimore, Cleveland, Denver and Seattle associations, and the farther west the clearer and more modern seems the basis adopted for the consideration of the question which is now before what is undoubtedly the most prominent of all engineering societies.

For a moment drop consideration of the reports of the three more eastern branches. A brief quotation from the letter of the president of the Seattle association which is appended to the report will indicate accurately the attitude which has been taken in the Northwest in attacking the question treated in the report of Messrs. Bontecou, MacDonald and Jonah. "The hope and inspiration of the proposals herein made is to strengthen the local associations and to see them become the active, energizing units of the society. We believe that they can thus be made the means of healthily expanding the membership and usefulness of the society and, among other things, of making it more capable of serving the public interests as well as the immediate interests of the membership." They feel that an organization of 7000 corporate members should have outgrown its swaddling clothes and that the voluntary assembly or "town meeting form of business meeting" now provided by the constitution should be superseded by something less archaic and more adapted to the present needs. They ask as a substitute a delegated organization which should act as the successor of the present system. They ask that the locals be considered as the basis for representation, feeling that a proper geographic distribution of representatives at business meetings would secure a wider interest in society affairs and a less formal consideration of important matters that may came up or that should properly be entrusted to such meetings. The Seattle association realizes that this would mean a radical rewriting of Art. 8 of the Constitution, but it offers no apology in forwarding any measure, however radical it may be, which may result in a more practicable form of organization. They anticipate a society truly national in character and influence, and feel that in many particulars such an organization should be totally different from the present scheme, not only because of the periodic necessity of cleaning off the barnacles which the years are bound to attach to any organization, but because a fresher attitude is being forced by conditions of an age for which the engineer is responsible, and of which he must consider himself the leader.

The *Engineering News-Record* has always felt that there was much more than a superficial and honorific value attaching to membership in the American Society of Civil Engineers. Nay, it has felt that if the civil engineers in this country were in any way to achieve the ends which they desire and the place which they deserve, that they should look to that society as the one most certain and efficient method of securing what it is they may want and deserve. However, this feeling has ever been qualified by the belief that many of the society's customs are hallowed only by age, and that many of its habits have long been devoid of any value—that unless some radical operation were performed, an operation which would secure in many ways an entire new bias for the society, no vital advance could be expected. There is needed not a mere modification to compromise with present conditions, but almost a rebirth of a spirit similar to that which originally resulted in the organization of the society. For though adequate at that time, the then satisfactory method of procedure now not only proves to be a drag on needed action, but results in an irresponsiveness to modern conditions which is deplorable to say the least.

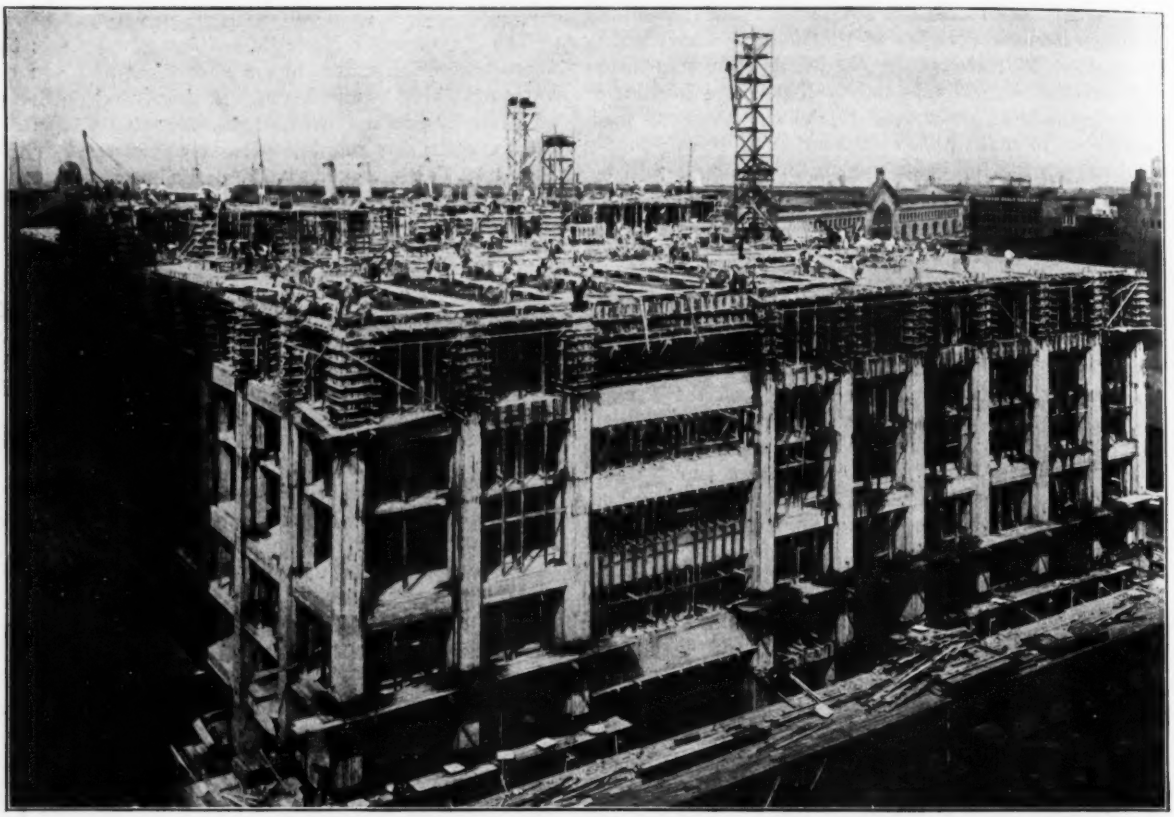
For this truth must never be lost sight of—in nearly all matters that affect the community life, men of the engineering type of mind and with the engineer's training are the predominant figures. Consider for a moment that in matters of health the engineer saves more lives through his provision of clean water, sanitary sewers and related products of his activities than does the doctor; in investments the first thought and the main reliance of the wise banker is the engineer; in rapidity and economy of manufacture, the engineer; in industrial disputes, logically the engineer. And what is there to limit the man who is provided with the tools of science and a desire for an application of his knowledge?

But to attain this place, the profession must attain first the consciousness of itself and its destiny. Its organization must be formed with an eye single to this purpose. No antiquated formula should be allowed to interpose its moribundity between the need and the fulfillment.

To this end the *Engineering News-Record* pledges its full support. It feels that in the work ahead no tradition should be spared—except only that of the high integrity which has always characterized every action of the society. Personal preferences, ideals which have outgrown their usefulness, forms that have no firm rooting in today should be ruthlessly eliminated, and in their place should be erected a structure fitted to the necessities which now confront engineers, and plastic to meet new conditions as they arise. It is only by following this ideal that the society can ever attain to its full usefulness.

Large Cold-Storage Building Introduces New Problems in Concrete Design

Complications Result from Division of Building Into Five Separate Parts by Insulation, Which Required Split Columns and Intermediate Walls—Heavy Flat Slabs and Columns Are Features



PUTTING UP AN ELEVEN-STORY CONCRETE COLD-STORAGE WAREHOUSE ON NEW YORK'S WATER FRONT

A REINFORCED-CONCRETE building of considerable size and complication in design is now being erected for use as a cold-storage warehouse by the Merchants Refrigerating Co. on the city block between 10th and 11th Aves. and West 16th and 17th Sts., New York City. In addition to being very large—it has 10 stories, with basement, mezzanine and attic, is 150 ft. high, and covers an area of 1.4 acres—the building is of novel design to take care of the separation of the various insulated portions. The insulating walls of cork composition separate the building into units, in which different degrees of temperature are maintained. It was necessary, in order to insulate thoroughly each section, to have these walls continuous, which involved the separation of the columns and floor slabs to permit the entrance of the insulating material.

The building is on the Hudson River waterfront in the Chelsea pier section of the city. It extends 184 ft. along 10th Ave. and reaches back to 11th Ave., which is 286 ft. away on West 16th St. and 357 ft. away on West 17th St. Eleventh Ave. is the marginal street fronting the transatlantic pier sheds. There are eleven usable floors, the first floor and a mezzanine between the first and second floors being devoted to office and store space, and nine floors to the refrigerated portions. Above the top floor there is a low attic, separating the roof from the insulated top floor. This attic serves mainly as an insulating air space, but has openings in it so that it can be used for certain kinds of rough storage. It is not refrigerated.

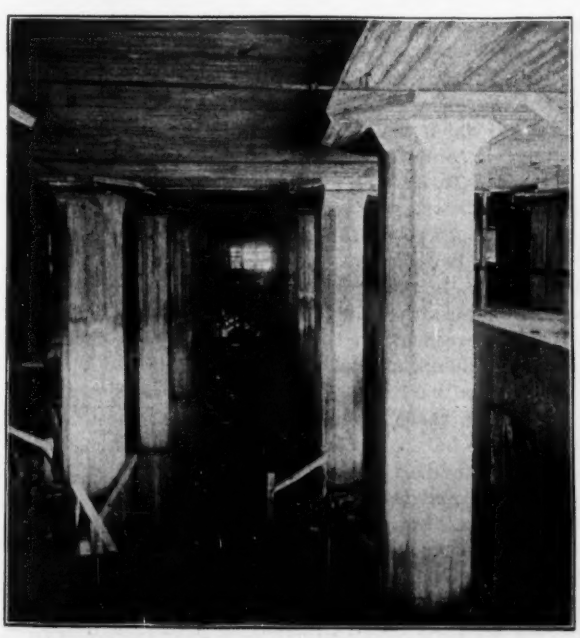
The structure is of reinforced-concrete frame throughout, with brick curtain walls carried on concealed spandrel beams placed at every other story. The lower office floors are provided with the usual windows and doors, but the storage floors have only occasional windows, and these are merely for ventilation for special occasions. They are provided on the inside with refrigerator doors which are opened only when the floor is to be cleaned or repainted and ventilated from the outside air, or on the few days in winter when outside temperature is below that required in the storage rooms.

The excavation was made in a site which at one time had been used for a gas works. Considerable trouble was encountered in removing the footings to two old

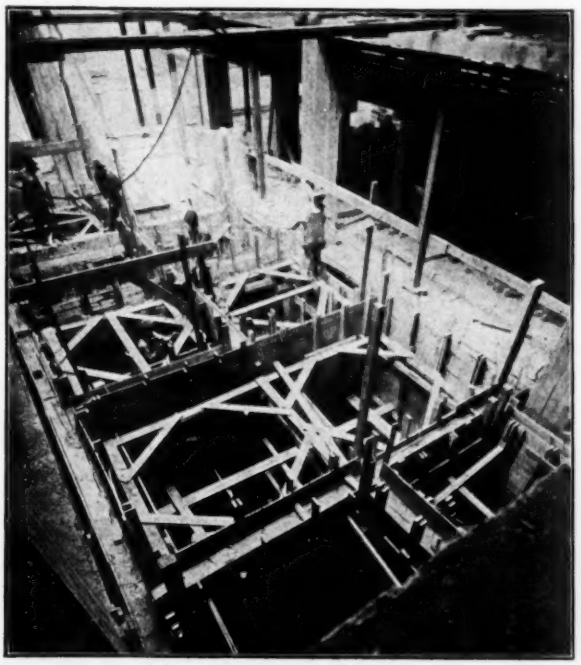
gasometers found in the northwest corner. The ground was very much more waterbearing than anticipated, and while the original design called for pedestal footings on the ground itself, a great number of piles had to be driven to bring the bearing value up to a safe one. These piles were, as a rule, concentrated under the columns, though in some few cases they were cantilever and distributed bearings carrying several columns on one general base. About 90% of the area was piled; the rest is solid earth. Pumping had to be maintained largely throughout the foundation operations, and the whole foundation wall will eventually have to be waterproofed against the ground water.

The insulated portion of the building extends from the second floor to the attic. The first floor, as previously stated, will be given over to retail commission stores and the mezzanine to offices, although a future elevated railway line, projected for the west side of Manhattan Island, will bring tracks in at the level of this mezzanine. In plan the building is separated into five transverse sections by insulated fire-walls. Each of these sections is independent and constitutes a separate insulated building from the second floor to the attic. Different degrees of temperature will be maintained in the several sections, the one at the 11th Ave. side being for cold storage—that is, having an average temperature of 20° F.—the next two being the sharp freezers where temperature as low as 15° below zero will be maintained. The two toward the 10th Ave. side are left for the time being without insulation and are to be used only for nonfreezing storage. Provision is made for future placing of insulation and brine pipes in case the two sections are turned into cold storage.

To insure complete insulation, special provisions were made at the junctures of the tenth-story columns and the attic floor and along the columns of the second story. At these locations the insulation is turned along the columns so as to increase the distance the heat would have to travel in case it passed through the floors immediately alongside the columns. The details of these increased insulating strips are shown in the drawing of the insulating layout.



LOOKING THROUGH CORRIDOR FOR RAILWAY TRAINS



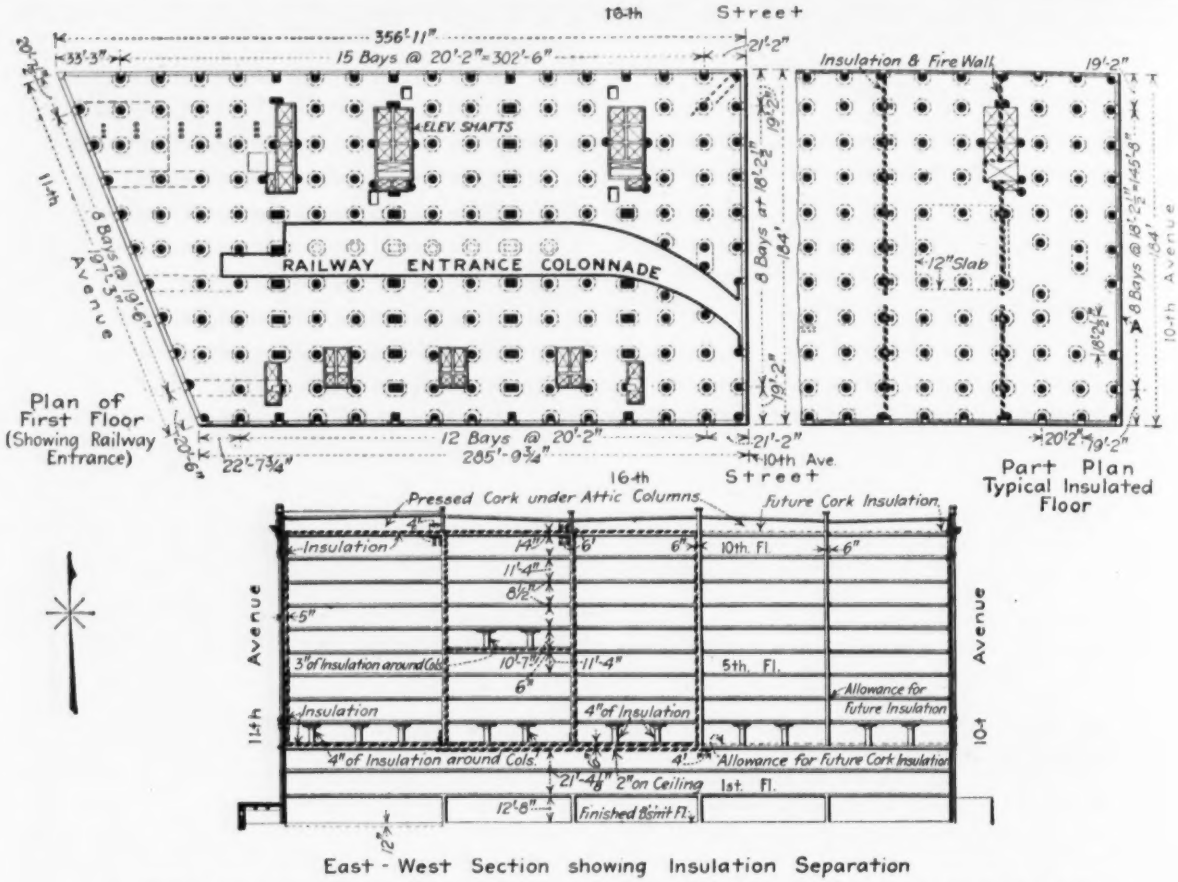
LOOKING DOWN ON FORMWORK FOR ELEVATOR SHAFT

The division into sections requires that all columns at insulation above the second floor be split to permit the entrance of insulation and that floor slabs be carried only to the columns, the space between the two split portions of the column being filled not only with insulation but also in the interior section divisions with a concrete firewall and at the outside with the brick curtain wall. This separation of different parts was complicated by the presence of elevator and stair shafts, as shown on the plan. There, however, the separation was carried straight through the elevator shafts, which were built, as shown in one of the views, as entirely separate structures rising from the foundations to the roof. The insulation is then placed around the elevator shafts and refrigerator doors are provided.

The insulating material consists of cork composition board which comes in sections 2 or 3 in. thick and about 2 x 4 ft. in plan. It is plastered on to the completed concrete floors, ceilings and walls by a cement mortar and is covered on the showing face with a ½-in. cement mortar finish. Thickness of this insulation varies, with the exposure of the wall to the sun and with the degree of refrigeration required, from 5 to 8 in. Thus, the north and west walls have only 5 in. of insulation, while the south walls where the sun is strongest has 8 in.

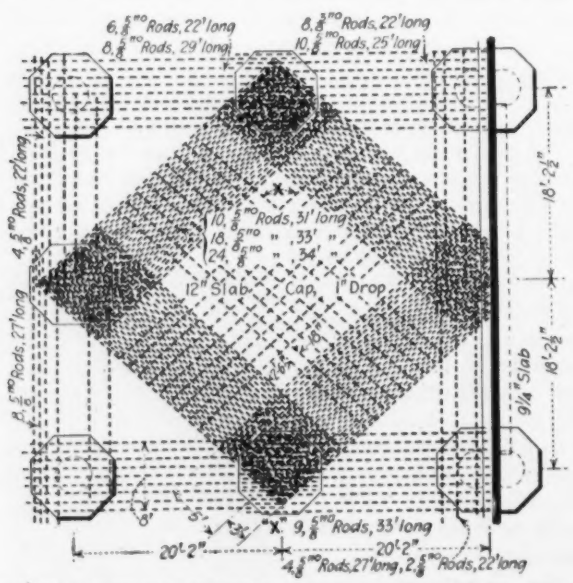
SPLIT WALL COLUMN

The reinforced-concrete flat-slab type of construction



FLOOR PLANS AND INSULATING DETAILS OF COLD-STORAGE WAREHOUSE FOR MERCHANTS REFRIGERATING CO. IN NEW YORK CITY

was used throughout. A typical detail of one of these slabs and columns is shown in the drawings, and this detail varied only in a few places. The regular slab thickness of 8¼ in. was increased to 9¼ in. throughout the sharp freezer sections to take care of the additional load of insulation, and to 12 in. in the first and second floors as a fire stop, according to the Underwriters' regulations. The main variations from the standard panel detail were two.



SPECIAL REINFORCEMENT FOR 40 x 36-FT. PANEL OVER RAILWAY COLONNADE

One of these is at the 11th Ave. side of the building where the square column location was prohibited by the skew, which would have brought two columns immediately alongside of each other next to the wall. In these places the column on the corner of the square nearest the wall was omitted and, owing to the length of span made thereby, the drophead was continued between the two columns as a longitudinal beam. In order, then, to take up the reaction to the cantilever action on the other side of the column, the drophead with reinforcement in the upper flange was continued back one column, as shown in the drawing.

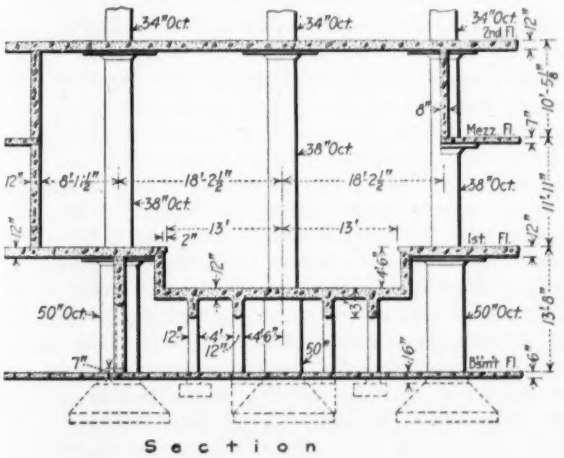
The other variation in the detailing was near the 10th Ave. entrance, where provision for a main-line railway had to be made, as described later in this article. On account of this railway entrance, one column had to be omitted and the span of the flat slab thereby increased. Leaving out this column increased the floor slab square from the 20 x 18 ft. of the typical panel to one of 40 x 36 ft. This very considerable span was taken care of by additional diagonal bands connecting the middle columns on the side, as shown in a special detail in one of the drawings. The slab was increased

to 12-in. instead of the 8½-in. thickness of the adjacent panels, and the reinforcement designed accordingly. The slab, therefore, becomes a slightly rhomboidal area about 28 ft. in span, between the diagonal bands connecting the intermediate columns.

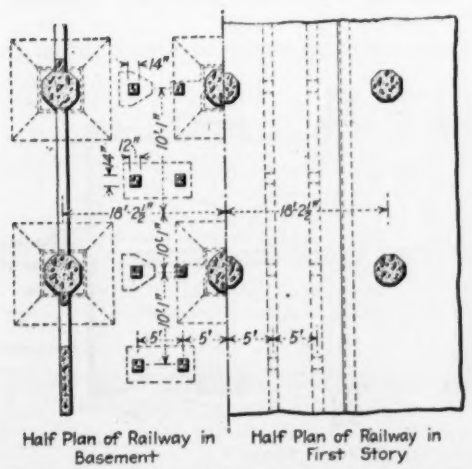
At the division walls the flat slab rests on the separated sections of the split columns, and where the division walls intersect the outer walls there are three columns, the outer one of which carries the spandrel girders and each of the inner two its respective slab.

The interior columns are octagonal in shape, spirally hooped in the lower sections, and, when the loads commence to reduce toward the top, reinforced only with straight rods and ties. They are of extremely large dimensions, particularly in the basement, some of these sections reaching as high as 84 x 36-in. In one or two places the reinforcement consists of twin spirals, one at each end of an oblong column section.

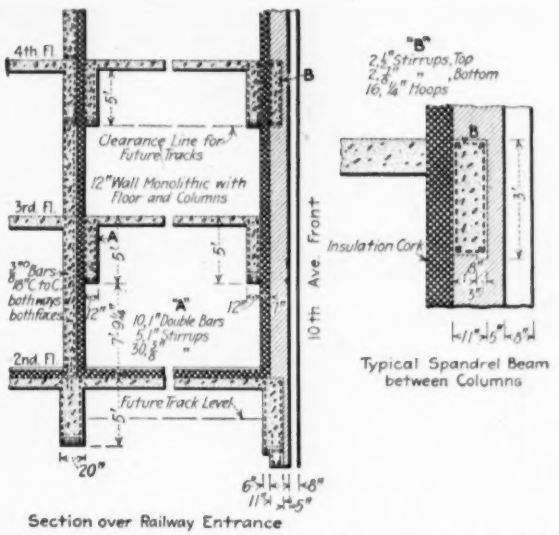
As noted before, the columns are split on the curtain walls and along the dividing walls to take care of the insulated sections. A detail of the split wall is shown in one of the drawings and a view of a wall column is also presented. In the upper part of the building; that is, above the first five stories, the wall column is braced at each floor slab by being tied to the slab column with two 1¼-in. bolts set in pipe sleeves in the interior columns. The pipe sleeve is placed there in order to



Section



DETAILS OF RAILWAY COLONNADE ENTRANCE



TWO SPANDREL GIRDERS OVER RAILWAY TRACKS OF SPECIAL DESIGN

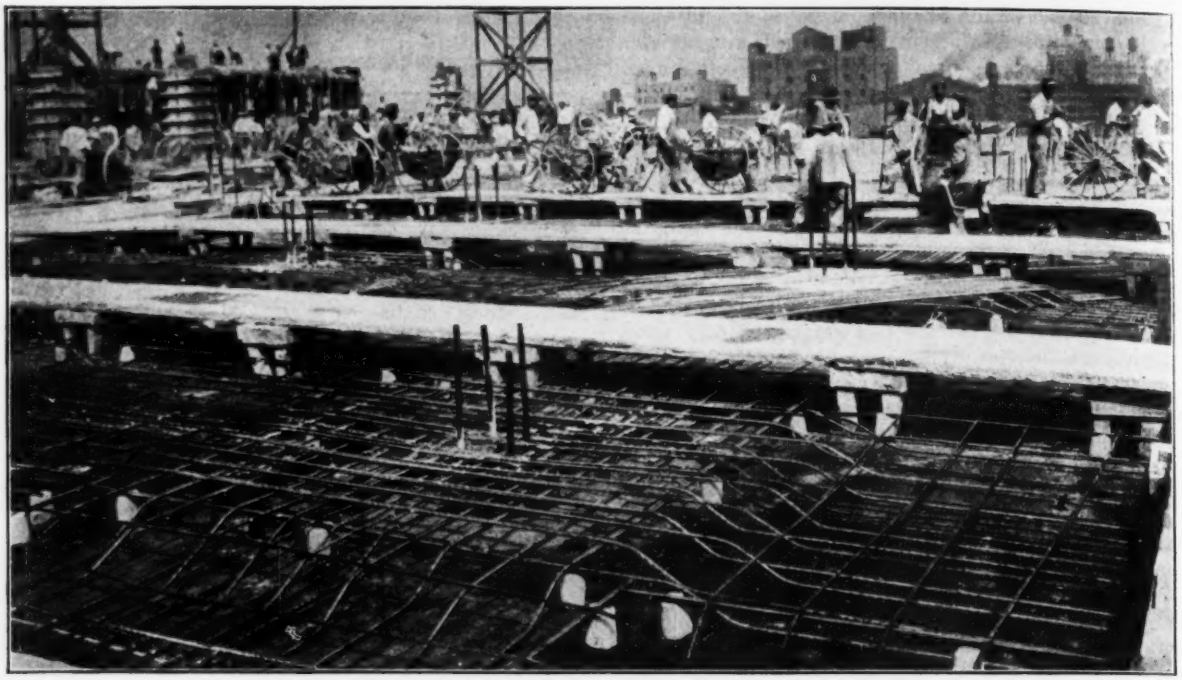
permit some vertical or horizontal movement, due to expansion of the building. Below the fifth floor, where the movement is expected to be less, the tie between the two sets of columns is merely two 1¼-in. rods set into the concrete of the two columns.

The roof columns are short stub lengths 6 to 8 ft. long, which rest on the insulating cork placed on the top of the floor. They are based on square pedestals 4 ft. each way, reinforced at the bottom with a rectangular mat of rods, as shown in one of the details. The roof, therefore, is to be carried entirely separated from the lower part of the building both as to structure and insulation.

The spandrel beams are placed at every second story and framed into the outside wall column, to carry the brick wall for two stories. In addition to the typical spandrel beams there are two other sets of beams to be noted; one spanning the railroad entrance into the building on the 10th Ave. side, shown very clearly in the view on p. 910, and the other spanning the railway into the second section of the building. These are each 5 ft. in depth at each floor, and are 36 ft. in span. They rest on the interior column and are separated from the exterior wall by the insulating cork. On account of the possibility of the railway entrance being raised to accommodate a future elevated railway entrance, it is necessary to make this bay to the first building entirely independent of the rest of the building, as will be noted from the drawing. It can be cut out at any time without affecting the remaining structure.

The railway entrance from the street-level track on 10th Ave. comes in at an angle and turns in, parallel to the side streets, about the middle of the building; it extends to the 11th Ave. side of the building. It requires an opening from the basement to the second floor, a height of about 26 ft., in which there is no cross-bracing. A view down this alleyway, during the construction of the building, is shown in one of the pictures.

In some of the lower columns the reinforcement is very slight, because at the present price of steel it was found cheaper to use a concrete section, where space



POURING ONE OF THE FLAT SLAB FLOORS IN MERCHANTS REFRIGERATING CO. COLD-STORAGE BUILDING

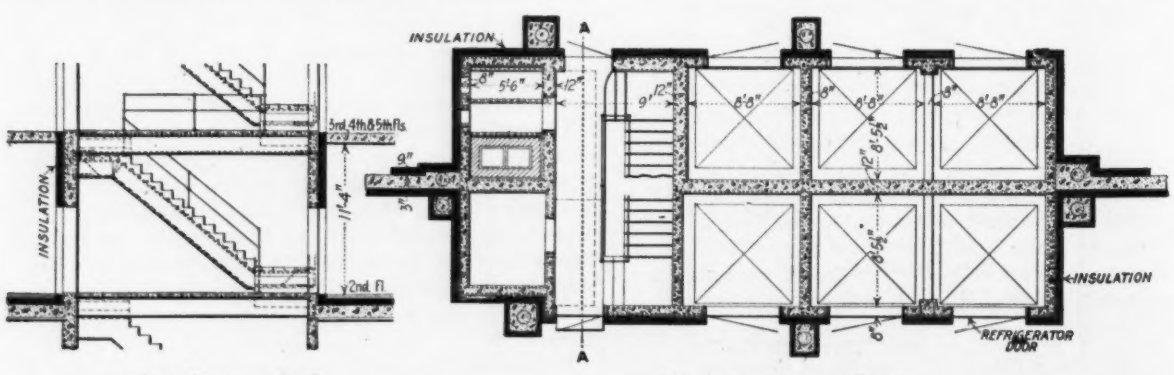
occupancy was not of importance, than to reinforce to reduce section. The railway itself is carried on short stub columns footing on piles and carrying longitudinal stringers, directly over which the tracks run, with an intermediate continuous floor. The rails are laid on short ties, a separate one to each rail.

The building is designed for live loads of 250 lb. per sq.ft. on all floors except the mezzanine, where 150 lb. are used. The railway entrance was designed for an E-50 loading.

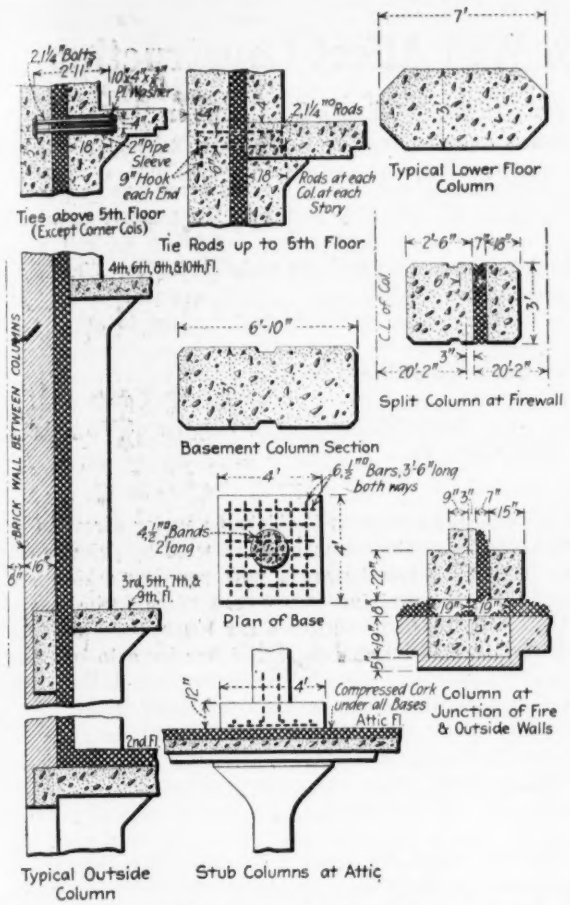
The ceilings had to be provided with inserts to carry the banks of brine pipes, which are bunched near the upper part of each story, and the dry-pipe sprinkler system, which was used in preference to the wet pipe on account of the freezing temperature. Refrigerating machinery is all concentrated in the basement on the 11th Ave. side. It is not of the size and complication common to cold-storage buildings because all of the power is purchased from the local electric company, thus doing away with all but the refrigerating units.

The construction work has been going on during the past summer. Excavation was made with steam shovels, and proceeded without difficulty. The rest of the building has been carried on with rapid progress. The material for the concrete was brought in to bins located in the basement alongside of the railway entrance. The sand and stone are being delivered by motor trucks along the runway in the railway colonnade, and dumped on grids over the bins. Cement is brought to the side street and delivered on rollers to storage alongside of the bin. Here two concrete mixers feed into elevators, which deliver onto each floor as the building is carried up. A view shows the floor under construction, with the numerous hand-pushed buggies pouring concrete on the flat-slab floor. The flat-slab layout is also shown in the same view. It will be noted that small concrete blocks are used to carry the reinforcement to proper height above the forms. The blocks are allowed to remain in the concrete.

The forms are of normal construction, except those



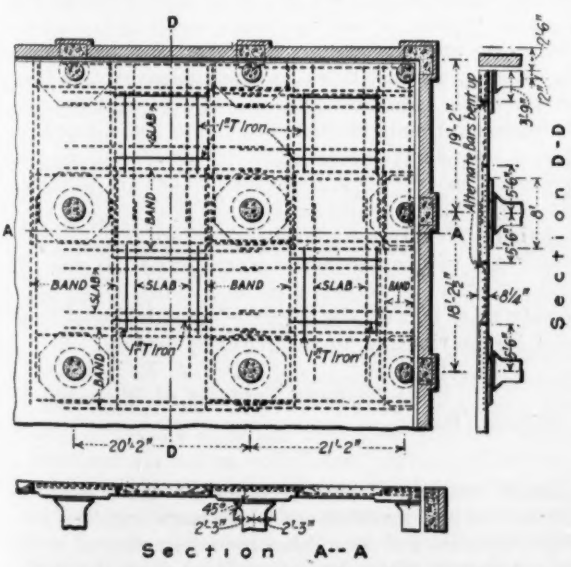
SHAFT COMPLETELY INSULATED FROM REMAINDER OF BUILDING


Typical Lower Floor Column
Ties above 5th Floor (Except Corner Cols)
Tie Rods up to 5th Floor
Split Column at Firewall
Basement Column Section
Plan of Base
Column at Junction of Fire & Outside Walls
Typical Outside Column
Stub Columns at Attic

COLUMN DETAILS OF COLD STORAGE BUILDING

for the split columns, which are somewhat involved in design. As shown in the cover picture in this issue, the forms for the split column are in one part, the three separate sections being blocked apart, and the whole bound with tie-rods and wooden braces. It is set up in one-story heights, and lifted to place, braced back to the floor forms, according to the regular practice for wall columns. At the bottom of the cover picture there will also be seen lying on the floor one of the octagonal interior columns. These forms are of wood. Some of the vertical ribs are of constant size, and others are of diminishing size to fit the reduction in sections of the columns as they go up. They are used over and over again by replacing the variable strip by one smaller in width. It will be noted also that these octagonal columns are held in place by chains.

The Merchants' Refrigerating Co. building was designed by John B. Snook Sons, architects, New York City, and is being built by the Turner Construction Co., also of New York City. The architect is responsible for the general layout of the building, the Turner Construction Co. for the structural design throughout. The original design called for a steel frame with concrete protection, but the building as erected in concrete is the design submitted by the contractor. All of the refrigerating details were designed by George Horne, of the Merchants Refrigerating Company.



TYPICAL FLAT-SLAB FLOOR DETAILS OF STORAGE FLOORS

Minnesota Health Board Controls Plans

UNDER a regulation recently adopted by the Minnesota State Board of Health, all plans and specifications for water-supply, sewerage and refuse-disposal systems for public use in that state must be submitted to and approved by the board before the proposed work can be carried out. The regulation, which has the force of law, is as follows:

"No system of water-supply, sewerage, or refuse disposal for public use, which affects or tends to affect public health, shall be installed, nor shall any such existing system be materially altered or extended, until complete plans and specifications for the installation, alteration or extension, together with such information as the State Board of Health may require, have been submitted in duplicate and approved by the board so far as relates to their sanitary features. All construction shall take place in accordance with the plans as approved, whether with or without modification. Whenever any governing body of any municipality having charge thereof shall determine that there shall be any material change in the plans, construction, or operation of any such system, such governing body shall submit to the State Board of Health, in duplicate, a detailed statement of such action of such contemplated changes before it shall enter upon the making of such changes or enter into any contract therefor or any part thereof, and then such changes shall only be made after approval as to all matters liable to affect public health, by the State Board of Health."

Dr. H. M. Bracken, St. Paul, is executive officer of the Minnesota State Board of Health.

Civic League's Paving Plans

The work of the Civic League of Cleveland, Ohio, according to its latest bulletin, has not extended beyond the inspection of work already under construction, but it is intended in another year to widen its activities by making its influence felt in the selection of types of pavement for different kinds of streets, and in the drafting of specifications.

How Road Material Embargo Will Affect Construction

At "Engineering News-Record's" Request State Highway Officials Give Views on Local Effect of Priority Board's Order No. 2

IN ORDER to learn the effect on road-building in various sections of the United States of order No. 2 of the Priority Board of the Council of National Defense, which, effective Nov. 1, prohibited the use of open-top freight cars for the shipment of "materials and supplies, other than coal, for the construction, maintenance or repair of public or private highways, roadways, streets or sidewalks," *Engineering News-Record* has asked a number of state highway officials for a brief statement of the local situation. (For Priority Board's order No. 2 see *Engineering News-Record*, Nov. 1, page 855.) The following replies, by telegraph, have been received:

The department not seriously hampered by Priority Board embargo. Content to leave matter with the Priority Board. CHARLES J. BENNETT,
State Highway Commissioner of Connecticut.
Hartford, Conn.

Priority Board embargo on road material has practically closed down all contract work for roads in the State of Maryland, cutting off supplies at many points for maintenance. There is no available material for maintenance on the eastern shore; all must be shipped in. The ruling of the board has eliminated many materials for this purpose. If order cannot be modified, very little, if any, new work will be undertaken and roads on eastern shore, where there is no local material for hundred miles or so, will practically go to pieces for want of repairs. Commission has given all contractors permission to close down their work which, in many instances, has been left in very bad condition, since no notice was given that such an order would be passed. Contractors were not prepared to close down and their loss will be great due to this order.

H. G. SHIRLEY,
Chief Engineer,
State Roads Commission of Maryland.
Baltimore, Md.

Order No. 2 of the Priority Board has had the effect of closing down a great deal of the construction and maintenance work of this department, and with the failure of the Priority Board to give sufficient notice—which, we understand they were in a position to do—will mean that this work will have to go over the winter in its uncompleted state. This will cause not only serious inconvenience to the citizens of the country but a considerable loss to the state. We recognize that the successful prosecution of the war is the matter of first importance confronting the nation at this time, and this department and the state as a whole are not only willing but anxious to give all possible assistance under existing conditions, but we are of the opinion that the Priority Board was at serious fault in not giving the highway officials time to adjust their work and prevent unnecessary losses.

While we believe that a serious error has been committed by the Priority Board in the manner in which the order was issued, we are accepting its ruling as final until amended and are endeavoring to adjust ourselves to the conditions as loyal American citizens. At the same time we are making our plans to carry forward our important construction and maintenance work as soon as the embargo is lifted and weather conditions will permit. GEORGE P. COLEMAN,
State Highway Commissioner of Virginia.
Richmond, Va.

No existing contracts in Alabama under direction of State Highway Department are affected by priority order No. 2. Advertisements now running asking for bids on work requiring 66,000 tons of surfacing material, 52,000 tons of which are for Federal-aid projects, will be affected. Lettings will either have to be postponed or contracts awarded conditional on nullification of the order within a reasonable length of time.

W. S. KELLER,
State Highway Engineer of Alabama.
Montgomery, Ala.

Priority order No. 2 will affect only such state highway work as is done with imported materials, chiefly sand and stone. Concrete work is affected to greater extent than macadam. This year's concrete road work is completed and macadam work nearly finished. If in effect next year, the order will reduce concrete paving very largely, macadam to a less extent, but we will be able nevertheless to work to advantage in most counties on grading and surfacing with local materials, provided we can secure labor. We are anxious to improve our roads as rapidly as our facilities permit and yield to none in our appreciation of their importance, but realize the necessity in these times for curtailment in activities not absolutely essential. This year, in coöperation with the state and county councils of defense, we voluntarily gave a considerable percentage of our forces to the farmers at harvest time, but certain roads are essential and every facility should be given to permit their construction. Therefore we hope and believe that priority order No. 2 will be rescinded before spring. If not, we must accept it and refrain from acts which might tend to make more difficult the proper administration of railways in contributing to the national defense.

A. R. HIRST,
State Highway Engineer of Wisconsin.
Madison, Wis.

Due to issuance of priority order No. 2, all work of construction and maintenance where same required materials to be shipped by rail has been discontinued, work being done only where local materials are readily available. Unless this order is either rescinded or modified,

little, if any, work can be undertaken, and then only in such locations where local materials are available. Serious loss will be suffered if material cannot be obtained at least to properly maintain the main arteries of travel. Action with regard to existing contracts will depend entirely on conditions surrounding each individual case, proper allowance being made for conditions over which the contractor has no control. If national conditions will not permit of the rescinding of priority order No. 2 in its entirety, would suggest the modification of same to permit of the maintenance and reconstruction of main roads which may be determined by the United States Government authorities to be of national importance.

W. D. UHLER,
Chief Engineer,
State Highway Department of Pennsylvania.
Harrisburg, Penn.

Priority Board's embargo on road materials will doubtless entail closing down of a number of road contracts in California, both in state and county work, but on state work conditions might be worse, since many of the contracts had not advanced far enough to be affected much. The state contracts began late this year because new bond issue money was not available until Aug. 1, and many contracts are still at the grading stage, thus needing relatively little material requiring railroad transportation. Before order became effective many cars of gondola type belonging on Pacific coast were already in East or on the way and flat cars and many box cars have been withdrawn recently from highway use so prospects are very gloomy for paved roads until embargo is lifted. On mountain laterals, however, where work consists chiefly of grading, construction will probably advance more rapidly than contemplated heretofore. The commission will continue to let new contracts and carry on those existing wherever possible, even hauling some materials by motor truck, and do all else possible to assist contractors and lessen their losses, but of course the needs of the nation in the present emergency are paramount and the state will do nothing to embarrass the Government by attempting to upset the priority order.

A. B. FLETCHER,
State Highway Engineer of California.
Sacramento, Calif.

Enforcement of priority order No. 2 has left some counties in Kentucky in unsatisfactory condition. This applies particularly to mountain section where there are no limestone deposits. Several counties are building roads, using sandstone base limestone surfacing. Base course has been placed for considerable distance and unless covered with limestone previous work will be practically lost. In majority of counties material can be gotten locally, though sometimes of inferior grade. Such counties not seriously affected by order. Contractors in some instances have been affected, because order was passed on such short notice. Where only small amount of work remains uncompleted it is probable that counties will release contractors from completion of work. Of opinion roads are necessity instead of luxury. Know positively if we could have few more connecting roads, especially in eastern Kentucky, great deal of foodstuffs could be marketed which now are going to waste. Also, coal conditions would be helped, because coal could be hauled to railroad stations by wagons and loaded in cars. Such is being done where we have built roads. Our aim is to coöperate with Government in enforcement of all orders in this war. If officials feel order must stand will do best possible under circumstances

R. WILEY,
Commissioner of Public Roads of Kentucky.
Frankfort, Ky.

Regarding the effect of Priority Board embargo on road materials, permit me to say that the present indications point to the necessity of closing down road work for the season. Just how soon I am not at present able to state, as we may be able to substitute truck hauls for car delivery.

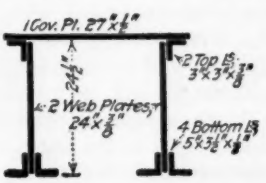
CLINTON COWEN,
State Highway Commissioner of Ohio.
Columbus, Ohio.

Priority order affects ten sections uncompleted road, for several of which materials are being shipped in box or flat cars. One section bituminous macadam, base course materials having been distributed, base course will be finished as waterbound macadam, substituting local gravel for screenings. No attempt to undertake new work or to carry on uncompleted work except to finish short stretches. Surveys and plans for $4,500,000 worth of road work will be made this winter and contracts awarded spring of 1918 if conditions warrant.

C. OLDER,
Chief Highway Engineer of Illinois.
Springfield, Ill.

Moment of Inertia Computing Simplified

THE usual method of computing the moment of inertia of a built-up structural section is to tabulate first the separate multiplications of area by distance from some axis to find the center of gravity, and then to make a separate tabulation of moments in which the area of each part is multiplied by the square of the distance of that part from the center of gravity. C. R. Harding, assistant consulting engineer, Southern Pacific Co., New York City, has found it simpler in his office to determine the moment of inertia first around the bottom of the section and then to transfer it to the center of gravity. The tabulation can then be made in one operation, as shown in the following typical example; as only one set of dimensions, d has to be determined, they can be used as multipliers twice, which is especially convenient when using a computing machine.



	Area		d		A.d		d		A.d²
Cov. Pl.	13.50 sq.in.	×	24.75	=	334.13	×	24.75	=	8,270
Top L's	4.22 sq.in.	×	23.61	=	99.63	×	23.61	=	2,352
Bott. L's	16.00 sq.in.	×	0.91	=	14.56	×	0.91	=	13
Web. Pls.	18.00 sq.in.	×	12.25	=	220.50	×	12.25	=	2,701
Total area =	51.72				668.82	Cov. Pl.			0
						M. I. of Top L's			4
						M. I. of Bott. L's			16
Center of Gravity above bottom =						M. I. of Web. Pls.			864
668.82 / 51.72 = 12.93 in.						M. I. about bottom			14,220
					51.72 × 12.93² =				8,647
						Moment of Inertia =			5,573

Tests Show Tightness of Flexible Joint Pipe Crossing New York Harbor

HYDROSTATIC tests conducted last year by the New York Board of Water-Supply on the 10,300 ft. of 36-in. pipe forming the Narrows siphon of the Catskill aqueduct showed a leakage of 5.6 gal. per minute at a pressure of 130 lb. and only 1.5 gal. per minute at 100 lb. The following details of the tests are given in the 1916 annual report of the Board of Water-Supply, J. Waldo Smith, chief engineer:

After the completion of the pipe laying on July 10, 1916, a hydrostatic test was made on the pipe between the 36-in. gate on the Brooklyn shore and the 36-in. gate on the Staten Island shore, a total length of over 10,300 lin.ft. of 36-in. pipe, of which 9740 ft. were of the submarine type. The presence of air trapped in the pipe, which was estimated from data secured during the test as amounting to as much as 20,000 cu.ft., made the measurement of leakage somewhat difficult, but by repeated tests a satisfactory result was obtained. The leakages at the pressures recorded in the first paragraph are said to be considerably less than is allowable for land lines of similar size. Further proof of the remarkable tightness of this line was furnished between Oct. 21 and Dec. 1, when the pipe was subjected continuously to the service pressures in the Staten Island mains, varying from 100 to 110 lb. per sq.in. The water supplied from this service was measured through a small meter placed on a by-pass around a 36-in. line valve. The total average leakage recorded for a period of 40 days, from the 10,300 ft. of pipe under test, was only 0.78 gal. per minute.

In August, the line was flushed out with water from the Brooklyn supply through the blow-off in Staten Island to remove salt water and dirt from the submarine line. Before the flushing, 200 lb. of hypochlorite of lime were put in the pipe on the Brooklyn side. Samples of water were taken and the pipe was found to have been satisfactorily flushed out. Measurements were also taken to determine the flow of the corresponding loss of head. While no very accurate figures could be obtained, an approximate flow of about 19,000,000 gal. per day with a loss of head of about 20 ft. was measured. This corresponds roughly to a coefficient of 110 in the Chezy formula. The line was again flushed out, using for a short time a flow of about 22,000,000 gal. per day.

The Narrows siphon was used by the Department of Water-Supply, Gas and Electricity during November and December, 1916, for the delivery of water from one of the Brooklyn high-pressure fire stations to Staten Island, and was of inestimable service in preventing a serious shortage in the Borough of Richmond.

State-Aid Hard Roads for Indiana

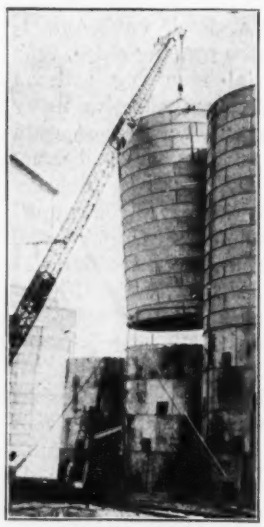
FIVE ROUTES of main "market highways" have been designated by the Indiana State Highway Commission. All of these will be hard-surface roads, but the kind of pavement has not yet been selected. No contracts will be awarded this fall, but plans and specifications are now being prepared for next year's work, and it is hoped that about 200 miles of hard-surfaced roads will be built in 1918. The Indiana law provides that the state may pay 50% of the cost and the counties must pay at least 50 per cent. The Commission intends to place all Federal-aid and state-aid money in one fund to pay half the cost of the improvements, the remainder to be paid by the counties.

The five routes mentioned are approximately as follows: (1) From the Michigan line through South Bend and Indianapolis to Jeffersonville, on the Ohio River; (2) east from the Illinois line through Dyer, Elkhart and Fort Wayne to the Ohio line, by way of the Lincon Highway; (3) the old National Road east from the Illinois line through Terre Haute, Indianapolis and Richmond to the Ohio line; (4) east from Evansville through Newburgh, Jasper, West Baden and Aurora to the Ohio line; (5) east from the Illinois line through Vincennes to Mitchell.

L. H. Wright is chairman of the commission and William S. Moore is state highway engineer, with offices at Indianapolis.

New Bottoms for Old Grain Bins

TO ENLARGE circular steel grain bins at an elevator plant it was proposed to add new sections on the top, but investigation showed that the old bins were not strong enough to carry the additional weight. It was then decided to shift the old bins, build the new sections on the old foundation and replace the old bins on top of the new sections. The view shows one of the old sections being placed. At the right is a complete bin, and at the left is one of the new bottom sections ready to have the old section set upon it.



OLD GRAIN BINS ARE SET ON NEW BOTTOMS

There are six bins in all, having a diameter of 19 ft. The old sections are 30 ft. high and the new bottom sections 20 ft. high. The difference in size of the plate rings is very evident. The sections are connected by a riveted ring joint, reinforced by vertical bars on the inside. When the bins were completed they were surmounted by a new roof and conveyor gallery. This work was done by the Minneapolis Steel and Machinery Co., for the Spaulding Grain Elevator Co., of Warren, Minnesota.

Good Roads Return Actual Dividends

Definite cash returns come to Colorado through increased tourist traffic because of its good-roads system, according to T. J. Ehrhart, commissioner of the State Highway Department. At least 40,000 automobiles, carrying 180,000 persons, visited the state this season. Each person is estimated to have remained in the state 25 days and to have spent $3.20 per day, or $15,600,000. Mr. Ehrhart estimates a 20% profit, or $3,120,000, for Colorado business men. The 1918 season is expected to bring 60,000 cars. This business promises soon to be the greatest single resource of the state.

Low Movable Dam Has Sloping Ends with Triangular Gates

Shutter Barrier in Philippines with Concrete Sill Following Bank Slope Has Reduced Flood Losses

By C. G. Wrentmore
Consulting Engineer, Manila, P. I.

CARRYING of the sills of a shutter dam up the bank slopes of the stream so as to reduce waterway obstruction is the principal feature in the design of two small irrigation dams built by the writer. This arrangement not only causes a minimum contraction of waterway and removes the danger of eddies common at the shoulders of shutter dams, but also is cheaper than the ordinary dam of this sort, with no loss of stability or durability. Two such dams were built for small irrigation systems in the Philippines, but as they are similar in detail one only will be described here.

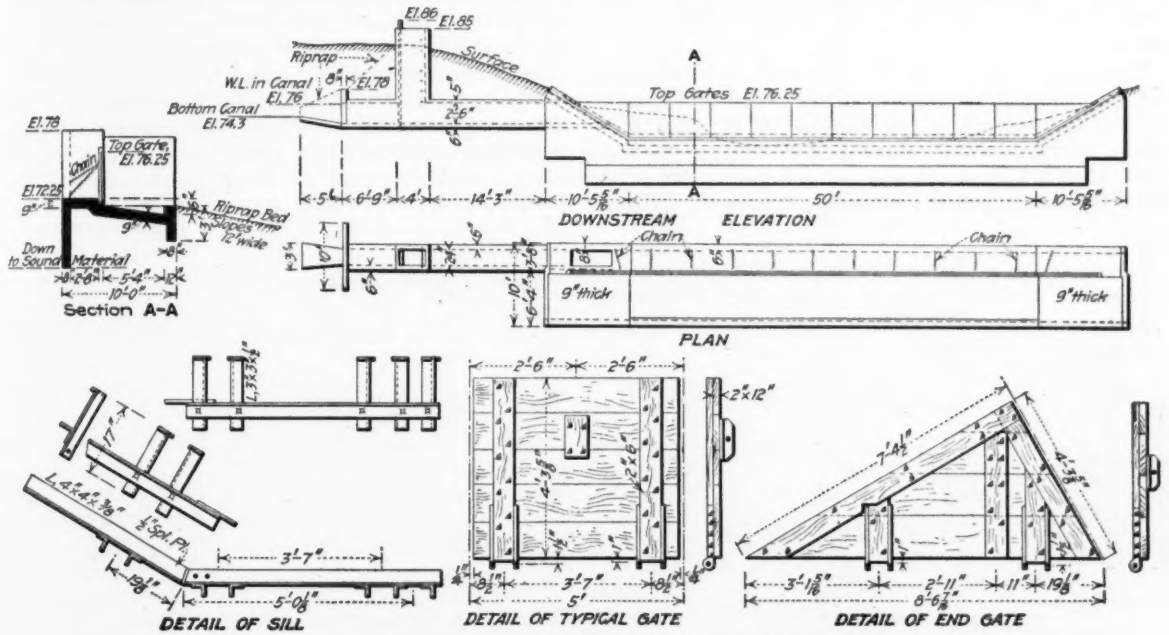
The stream at the point of diversion has a well defined channel, with banks which rise from the stream bed on a slope of about seven on twelve to near the level of the adjacent land, which runs back from the stream very evenly and almost horizontally. Ordinary floods are contained within the banks, but extraordinary inundations may frequently overtop them.

It was evident that a dam thrown across this stream in such a manner as to contract the cross-section by any considerable amount would, first, cause an ordinary flood to rise over the banks, and second, would tend to cause scour in the channel and expense in protection works. While the material is light and easily moved, the present banks below the site of the dam are well protected by tropical vegetation, and there is reason to hope that if no disturbance of the existing conditions is introduced the channel will hold its present position for many years.

In view of these conditions, a low lift was adopted for the dam, and the dam itself was designed in such a manner as not to contract the waterway at all and to change the form of cross-section as little as possible. The dam consists of a sill on the level of the stream bed supporting hinged gates or shutters, the lift of the water being entirely secured by the shutters. The sill is carried horizontally across the full width of the stream bed and at each bank is turned up on an angle to fit the slope of the bank. This sill is of concrete, with a curtain wall at the upstream edge carried down to impervious material, and having the downstream edge protected from scour by an apron of riprap sloped well down below the normal level of the stream bed.

On the concrete sill a sill of angle iron anchored into the concrete is carried across the bed and up on each sloping shoulder to an elevation slightly above the top of the gates. The latter are hinged to this steel sill with slotted hinge sockets to assure seating. The gates are held up against the water pressure by anchor chains and are released in case of flood by the shearing of a small wooden plug. When the gate falls it is cushioned by a pocket of water, thus protecting the concrete from the blow. The gates standing on the horizontal portion of the sill are rectangular, and rotate about a horizontal axis; those on the sloping portion are triangular, the axis of the hinge lying in the slope of the sill so that the gate swings somewhat back toward the bank as it falls.

A weak point in this plan is the device for tripping the gates. The writer has designed a number of tripping devices and has examined many others, but has seen none that comes near perfection and each has one or more features that are very undesirable. The one adopted is so low in first cost and so free from undesirable features, except the variation in load required to trip, that it has been adopted as the most desirable for this project.



SHUTTER DAM SILL RUNS UP BANK SLOPE

Speedy Road Condition Survey by Auto Cost Only $1.20 per Mile

Wisconsin Highway Commission Collects Data on 7500 Miles of Road as Basis for New Trunk Route System

BY THE use of automobiles, special blank forms and a code system in which numbers were employed to describe conditions observed, a survey of the condition of 7500 miles of road was made in less than three months by the Wisconsin Highway Commission at a cost of only $1.20 per mile. The survey will be used as a basis for selecting a 5000-mile trunk-line system to be constructed with Federal aid. The results of the survey, according to A. R. Hirst, state highway engineer, under whose direction the work was performed, are very satisfactory for the purpose intended and it is doubted if any more complete information could have been obtained in any other way except at greatly increased costs.

The statute enacted by the Wisconsin Legislature of 1917, providing for the coöperation of the state with the Federal Government in the construction of Federal-aid roads, requires that the State Highway Commission shall select a system of state trunk highways to which the Federal-aid construction shall be confined. The system is required to connect all county seats, and all cities with a population of 5000 or more. After May 1, 1918, the counties are required to maintain the entire system, the unimproved portions as well as the portions which have previously been improved under the state highway law or otherwise. The cost of construction and maintenance is to be paid from the proceeds of automobile licences. All construction will be administered by the State Highway Commission direct. The maintenance will be administered by the counties under the direction of the State Highway Commission and paid for by the state. Effective control is guaranteed by a provision in the law authorizing the State Highway Commision to withhold payment for work improperly done.

The law required that this system should be selected prior to Nov. 1, 1917. As the law did not become effective until July 11, any ordinary methods of surveying these routes could not possibly have covered the ground within the required time. A system was devised which, it is believed, gives the required information with a minimum of expense and a maximum of speed. The information desired is such as will enable intelligent estimates of the cost of future construction and maintenance and proper comparisons between alternate or competing routes to be made. The surveys are, in effect, reconnoissances; all future construction will be based on proper instrument surveys.

WISCONSIN HIGHWAY COMMISSION

Condition Survey Report on State Trunk Highway—Mile No. 10, Div. Survey No. 173, between City of Baraboo and City of Reedsburg, Known as the Baraboo-Elroy Road, Sauk County

Tenths of Miles	1	2	3	4	5	6	7	8	9	10	
1. Type-Condition	*4-1					*1-2	*1-3			*4-3	1
2. Soil-Drainage	2-1										2
3. Special conditions											3
4. Traveled way—surfacing	24-15		*20-9			*18					4
5. Between ditches—fences	28-50										5
6. Wooden—B-C		B-3									6
7. Stone—B-C											7
8. Steel—B-C								B-1			8
9. Concrete—B-C			C-1								9
10. Additional—B-C											11
11. No. spans—opening—co. rdwy		1-90-14						1-62-16			11
12. Floor—floor to stream b'd		3-3-20						1-1-29			12
13. Foundations		2-1						2-1			13
14. Intersecting roads—traffic						3-1-3					14
15. Turn-angle		90-2		90-1		90-2			3-1 80-2 90-1		15
16. Vision-danger	2-2	1-1		3-3+		1-1			1-2 2-3 2-2		16
17. Possible relocations											17
				Profile Datum Vert. Spaces = 20 ft.							
18. Railway and street Railway Crossings				1-1-3					1-1-3		18
19. Railways and street railways within right of way											19
20. Governmental limits											20
21. City construction limits											21
22. R. F. D. boxes—trail		Red Trail					R-1				22
23. School house—town hall											23
24. Church—factory											24
25. Farm residence—cemetery							R-1				25
26. 1917 state aid work											26
27. Miscellaneous						Mr. Black					27
28. Location of materials		Gravel pit		County pit							28

* NOTE:—Stop at end of each mile, consider notes carefully, and insert required estimates of Maintenance and Construction. Give estimate on Grading and Culvert Cost only where section must be constructed or reconstructed immediately to secure maintenance at a reasonable cost.

Estimated Maintenance 1918, $250. Estimated Grading and Culvert Cost on Imperative Construction $.....

Remarks: Country traversed in this mile is Good farming country, very crooked road.

Date 7-25-1917. Observer J. T. Donagbey. Recorder H. G. Kuelling.

SUMMARY (Do Not Fill Out)

Roads and Streets							Bridges and Culverts											
	Earth—1		Grav'l	St. Mac.	Conc.	Other	Total		Wood		Stone		Steel		Concrete		Additional		Total	
Cond.	Sand	Clay	4	6	9			Cond.	B	C	B	C	B	C	B	C	B	C	B	C
Good								Good												
Fair								Fair												
Poor								Poor												
Very poor								Very poor												
Total								Total												

MISCELLANEOUS

Item	No.	Item	No.		Safety			Condition			
					Safe	Medium	Dang.	Total	Good	Fair	Poor	Total
Intersecting Roads		Cemeteries		Grade Crossings								
School houses		Factories		Under grade								
Town halls		Residences		Overhead								
Churches		R. F. D. (miles)		Turns								
				Total								

All mileage measurements are made by automobile speedometer. The survey force consists of two men, an observer who also drives the car, and a recorder. The notes are taken on a specially devised blank, and are recorded by means of a code system.

Prior to beginning the survey, all speedometers to be used were carefully checked against a measured distance. The variations ranged from a few feet to more than 200 ft. per mile. It was found that these errors were caused by slight variations in the sizes of the tires of the car, and they were corrected by the use of tires of exact diameter.

Record Sheet and Code

A specimen of the record sheet and the code are shown. The record sheet is ruled horizontally into 28 spaces, one for each subject on which information is desired, and vertically into 10 spaces, each representing 0.1 mile. The subjects are arranged so that related subjects occur together, thus making the record come in a logical order, facilitating both the record and reading of the notes. The record is made almost entirely by numbers, it having been found that figures can be recorded more rapidly than letters. The record is made while the car is in motion, except for stops which are made to measure culverts or bridges and stops at the end of each mile to fill in the title blanks at the top of the sheet and make estimates of maintenance and imperative construction. All widths of right-of-way, distances between ditches, widths of traveled way and surfacing are estimated.

The title of the specimen sheet shows the location of the road and mile under survey. The mile begins with a gravel road in good condition which continues to the end of the fifth one-tenth, where there is an earth road in medium condition which continues for 0.1 mile, where it becomes poor and continues so to the end of the ninth one-tenth, where a gravel road in poor condition begins and continues to the end of the mile. The soil for the entire mile is a light clay. Drainage is good. The road follows the surface of the ground all the way. The width of traveled way at the beginning is 24 ft., the surfacing is 15 ft. This continues to the center of the second one-tenth, where the traveled way and surfacing narrow to 20 ft. and 9 ft. respectively, and so continuing to the end of the fifth one-tenth. The last five-tenths have a traveled way of 18 feet.

In the second one-tenth there is a wooden bridge consisting of a single span of 90 ft., 14-ft. roadway. The floor is of planks in poor condition; distance from grade to stream bed, 20 ft. The foundations are of stone in good condition. In the third one-tenth there is a concrete culvert in good condition, size 2 x 2 ft., and 24 ft. long. In the eighth one-tenth is a steel bridge in good condition, a single span of 62 ft., 16-ft. roadway. The floor is reinforced concrete in good condition; distance from grade to stream bed, 29 ft. The foundations are stone in good condition.

A town road, carrying light traffic, turns off to the right in the sixth one-tenth. This mile is crooked at the beginning. A tortuous curve, medium vision, reasonably safe, is shown in the first one-tenth. In the second one-tenth there is a 90-deg. turn to the left, good vision; in the fourth one-tenth a 90-deg. turn to the right, poor view, exceedingly dangerous; and in the sixth one-tenth another 90-deg. turn, this time to the

SYMBOLS TO BE USED ON CONDITION SURVEY OF STATE TRUNK HIGHWAYS

1. A—Type
   1—Earth
   2—Sand-Clay
   3—Shale
   4—Gravel
   5—Gravel-Surface treated
   6—Stone Macadam
   7—Stone Macadam—Surface treated
   8—Bit Macadam
   9—Concrete
   10—Bit Concrete
   11—Asphalt
   12—Brick
   13—Other—give name
1. B—Condition
   1—Good; 2—Fair; 3—Poor
   4—Rebuild immediately
2. A—Soil
   1—Heavy Clay; 2—Light Clay or Loam; 3—Sand; 4—March
2. B—Drainage
   1—Good; 2—Fair; 3—Poor
   4—None whatever; 5—Center lower than ditch line
3. Special Conditions
   1—Mud hole; 2—Rock outcrop; 3—Present cut; 4—Present fill
   5—Side hill; 6—Dangerous ditch.
4. Travelled Way-Surfacing
   Insert in order estimated width of travelled way and surfacing as 18 ft., 9 ft.
5. Between ditches—fences
   Insert in order, estimated width between ditches and between fences as 24 ft.—48 ft.
6. Wooden Bridge-Culvert
   1—Good; 2—Fair; 3—Poor; 4—Rebuild immediately
7. Stone Bridge-Culvert
   1—Good; 2—Fair; 3—Poor; 4—Rebuild immediately
8. Steel Bridge-Culvert
   1—Good 2—Fair; 3—Poor; 4—Rebuild immediately
9. Concrete Bridge-Culvert
   1—Good; 2—Fair; 3—Poor; 4—Rebuild immediately
10. Additional Bridge-Culvert
11. No Spans—Opening—Clr. Rdwy.
    Give number of spans, size of opening, and width of clear roadway.
12. Floor—Floor to Stream Bed
    1—Concrete
    2—Creosote Blks.
    3—Plank
    1—Good
    2—Fair
    3—Poor
    4—Rebuild immediately
    Give distance from floor to stream bed.
13. Foundations
    1—Wooden Piles
    2—Stone Masonry
    3—Steel Tubes
    4—Concrete
    1—Good
    2—Fair
    3—Poor
    4—Rebuild immediately
14. A. Intersecting Roads
    1—State trunk
    2—State aid sys.
    3—Town road
    1—Right
    2—Left
    4—Four corners
    5—Five corners
14. B. Traffic
    1—Heavy; 2—Medium; 3—Light
15. Turn-Angle (in degrees right and left from foresight)
    1—Right
    2—Left
16. Vision—Danger
    1—Good
    2—Fair
    3—Poor
    1—Safe
    2—Medium
    3—Dangerous
17. Possible relocations
    1—Right
    2—Left
    Show limits of and estimate distance increased or diminished.
18. Ry. & St. Ry. Crossings
    Locate thus with angle / /
    1—Grade
    2—Overhead
    3—Undergrade
    1—Good
    2—Fair
    3—Poor
    4—Reb. Immed.
    1—Safe
    2—Medium
    3—Dangerous
19. Railways and Street Railways
    Within Right of Way
    Locate thus.....
    1—Right
    2—Left
    3—Center
    1—Safe
    2—Medium
    3—Dangerous
20. Government limits
    Locate town, village, city and county limits. Name central point in village or city. Also attach plat or map showing streets on Trunk System.
21. City Construction Limit
    Locate limits wherein your judgment construction should stop as per federal act.
22. R. F. D. Boxes—Trail
    1—Right; 2—Left
    Note trail followed, if any.
23. School House—Town Hall
    S—School House
    H—Town Hall
    1—Right
    2—Left
24. Church—Factory
    C—Church
    F—Factory
    1—Right
    2—Left
25. Farm Res.—Cemetery
    Cem. Cemetery
    R—Farm Residence
    1—Right
    2—Left
    Write owner's name in each mile.
26. 1917 State Aid Work
    Locate as near as possible all construction for which funds are available.
27. Miscellaneous
28. Location of Materials
    Give location of local materials available for construction and maintenance.
29. Remarks
    Describe any difficult construction feature, extremely dangerous point, or other matters of interest.

left, good view, safe. In the ninth one-tenth there are three turns; 3 deg. to the right, good view, medium safe; 80 deg. to the left, medium view, dangerous; and 90 deg. to the right, medium view, medium safe. An advantageous relocation of the entire mile is possible.

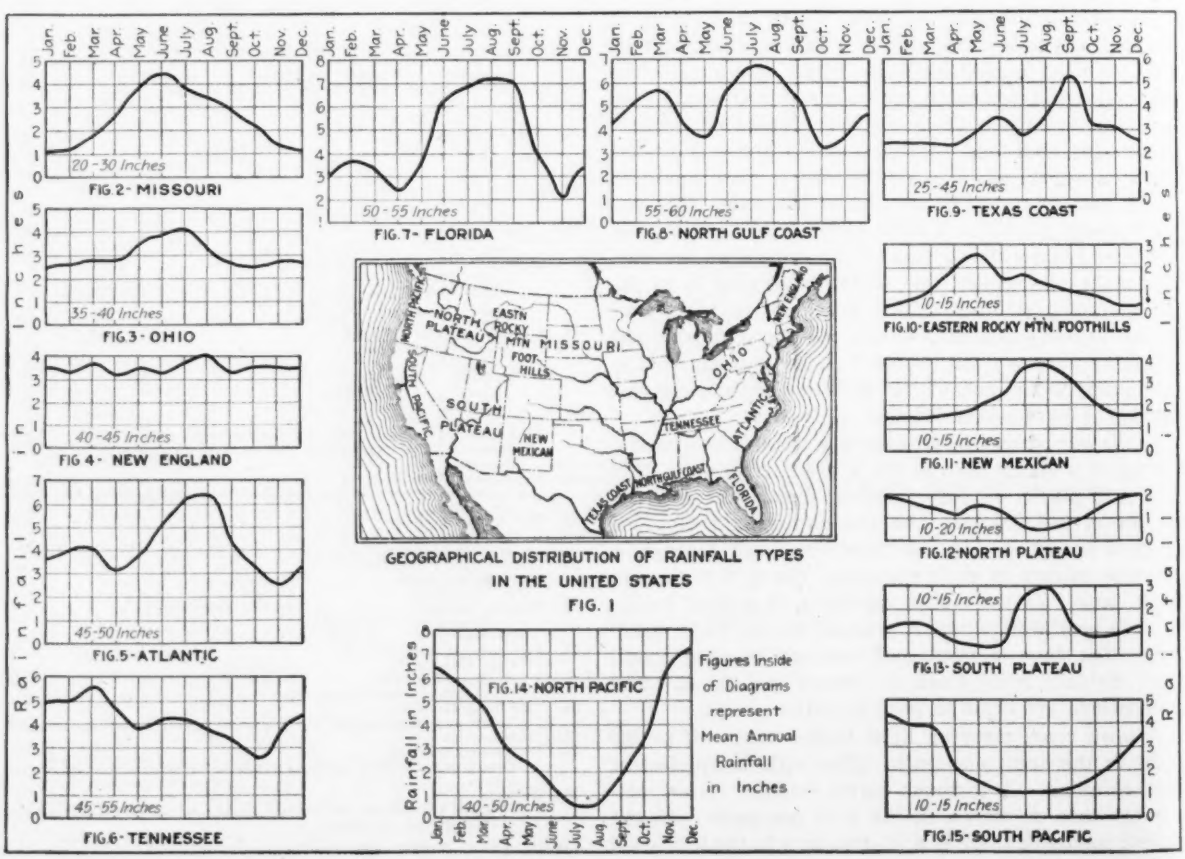
In the fourth one-tenth there is a dangerous grade crossing with the C. & N. W. Ry. The physical condition of the crossing is good. The same thing occurs again in the eighth one-tenth. Evidently the purpose of the suggested relocation is to avoid these two crossings. In the seventh one-tenth a mail box belonging to Mr. Black, whose residence is on the right hand side of the road, is noted. This indicates that the road is a mail route and thus eligible to Federal aid.

It is estimated that this mile can be maintained in reasonably good condition in 1918 for $250, without any additional grading or culvert construction

After the survey is complete, a summation of the total number of miles is made on a blank form, as shown. To insure uniformity, estimates of maintenance costs are made from a schedule of estimated maintenance costs for each type and condition of road. These range from $35 per mill for 18-ft. concrete roads in first-class condition, $150 per mile for earth roads in third-class condition to $450 per mile for 9-ft. macadam surfacing in third-class condition. The profile shown is intended to indicate only in a very approximate way the true ground level, and is plotted from observations of rise and fall made by the observer, assisted by a gradiometer attached to the body of the car. The elevation is taken as zero at the beginning of each mile. No attention is given to light grades of 1% or 2% or to the very short grades of anything less than 6%. The profile indicates whether the road is smooth, rolling or rough. The information noted is supplemented by photographs. Each party carries a camera and has instructions to photograph sections of road typical of the mile traversed, also any particularly dangerous situation. These photographs are attached to the mile sheet on which they occur.

Fifteen Monthly Rainfall Types of the United States

FIFTEEN typical rainfall types for the United States are presented by Prof. Robert DeC. Ward, Harvard University, in *The Geographical Review* for August. They are based on plotted monthly rainfall amounts for selected stations in all parts of the country. The curves and a key map outlining the corresponding geographical districts are reproduced herewith. As Professor Ward points out, neither the rainfall for any given station within a district nor the district overall for any single year should be expected to agree with the typical curve, which is a composite both of stations and years. The original article fills nearly a dozen pages of *The Geographical Review*. All the curves there given are reproduced here. The text, which occupies most of the space, is mainly a series of comments on each curve and on district variations from the type.



THE RAINFALL OF THE UNITED STATES IS PRESENTED GRAPHICALLY FOR FIFTEEN TYPICAL DISTRICTS

Hard Pavements Are Replacing Dusty Adobe Roads in Western Texas

New Towns Are Born and Land Values Increase Along El Paso County's 50-Mile System—Bituminous Type Favored—Concrete Roads Laid Under 5-Year Guarantee—Gravel Used for Secondary Roads

EDITORIAL CORRESPONDENCE

ROAD CONDITIONS in El Paso County, Texas, where $550,000 has recently been spent in building 50 miles of hard pavement, will surprise agreeably the average Easterner who gages Western roads by the major mileage of the northern middle-western states. On the latter, mud after rains or dust after summer droughts presents difficulties of nearly equal importance to motor or horse-vehicle traffic. In the dry climate of west Texas, however, the adobe and silt soils powder to so great an extent as to impede traffic materially. Although the Rio Grande valley has been settled for 230 years, it has had even fair roads only within recent years, but now the certainty of crops insured by the Reclamation Service dam at Elephant Butte has put new life into the old communities, to which water is now supplied when it is most needed.

The old, indifferently farmed ranches of the Mexicans are being transformed slowly by the modern methods of irrigation. Better farming results in increased tonnage to be transported to market. Alfalfa, baled as soon as cut, makes possible loads of two or three tons if roads are available over which to transport it. Wheat, grains, fruit, all in quantities far greater than formerly, demand roads with less tractive resistance. Railroads are not essential to the numerous small villages which spring up overnight at geographically convenient crossroads, for goods can be supplied readily from El Paso by motor truck. Another factor in the extension of the system is the fact that the ownership of many ranches has passed recently to men who live in town and motor back and forth frequently. No wonder, then, that a recent $350,000 bond issue carried easily, but not until the people learned just when the roads were to be built and what they were to be. A former proposed issue of $750,000 was defeated, it is asserted, solely because there was no definite plan for its expenditure.

A constriction of the valley at El Paso, due to a limestone outcropping, practically cuts the width of the tillable area to nothing, but below and above town the valley spreads out to 4- or 5-mile width between the foothills and the river. Plans to serve adequately these strips by through routes were easy to evolve. On the south side is Mexico. Traffic, therefore, is confined largely to a single main road to the east and west. Auxiliary parallel roads, the north and south loops, in the lower valley, are mainly for local use. For any long haul the short transverse distance to the main road is not a factor.

The 50 miles of newly constructed roads and much of the secondary system were inspected in September by a representative of *Engineering News-Record*, accompanied by L. A. White, county road engineer. Some of the pavements had been in use long enough to indicate the service rendered, and along all of them conditions of increased property improvement were noted.

Leaving El Paso for the lower valley, one encounters first 1½ miles of bitulithic pavement on Alameda Ave., which the county helped the city to build last year. It is a 90-ft. street, with double car tracks moved at the time of paving to the center, leaving two 27-ft. roadways with curbs at the edge of an unpaved 20-ft. strip for the car tracks. This type of pavement has been laid in the city for many years at a non-fluctuating price of $1.77½ per sq.yd. Its success in the city has been such, according to local opinion, that no other type has been able to get a foothold. Most of it is laid on a 6-in. bituminous base, but within the past six months fifteen blocks on Myrtle Ave. and eight on Bliss St. were laid on a 4-in. 1:4:7 concrete base. The bitulithic mixture is only 1½-in. thick. On Myrtle Ave. two rows of wood blocks are laid along the rails of the car track.

For 9 miles east to Ysleta, the oldest town in the valley, the road narrows to a 16-ft. poured macadam, which has been in service eight years. As originally constructed this pavement has a base of crushed rock, graded in size from 3½ in. down to ½ in., with coarser rock laid on the bottom. This was placed in rolled layers to a total thickness of 6 in. Hot asphalt was poured by hand over the top in the proportion of 14 lb. of asphalt per square yard of pavement. A covering of screenings, ½ in. to dust, was then spread and rolled. California and Texaco asphalts were used on about equal lengths of the road. There is no appreciable difference in the behavior of the two different asphalts. After three years' service the road began to show signs of wear and raveling, and was treated with a surfacing of one part sand to two parts of stone screenings mixed with 9% of asphalt.

At present the unprotected edges of the road to Ysleta are badly scalloped to a 14-ft. width and the surface shows raveled holes, unevenness and other signs of impending disintegration. Four years ago, when the writer inspected the road in company with Capt. Herbert Nunn, city engineer, now state highway engineer of Oregon, the poured macadam was in almost perfect condition and was believed to be good for ten years. Motor trucks of large capacity were few then, and no doubt a factor of safety of more than 1 did exist. The old poured macadam was laid to Fabens, 20 miles from Ysleta, in a 9-ft. strip. It has been replaced recently by a 14-ft. width of bitulithic, except for a distance of 4000 ft. in Ysleta, where it has been widened to 24 ft. The poured macadam was scarified, graded and rolled before adding the 4-in. of new asphaltic mixture. The price of this road was $1.25 per yard.

The county expects to repave the remainder of the poured macadam next season. In the meanwhile, re-

pairs on the holes will be made by picking out and replacing with a base of concrete covered with asphaltic mastic. (Since the above was written Mr. White writes that all the bad holes between El Paso and Ysleta have been filled with mastic, and the holes in the shoulders have been filled with earth.)

For 22 miles beyond Fabens to the county line is a gravel road that has been nearly ruined by the operations of motor truck trains which supplied Gen. Pershing's army in Mexico and in the "big bend" country to the southeast. An outfit of 22 men, 18 mules, one Russell grader and two horse-drawn rollers is now at work on this section. One of the rollers was made on the ground from three 1½-ft. sections of 72-in. Armco culvert pipe filled with concrete. This obviated a wait of two months for delivery of a roller from the manufacturers. Gravel is obtained from the foothills, the

EIGHT-YEAR-OLD POURED MACADAM NEARS END OF ITS LIFE

maximum haul being 6 miles, through sand. No effective rolling can be accomplished in dry weather, but a heavy storm in September permitted some work. Water for sprinkling from irrigating ditches is not available beyond 6 miles below Fabens.

After a rain the grader is run over the road, then a drag and finally a roller. Men precede the roller, picking out by hand the few stones above 2 in. The foothill gravel runs small and is well graded, so that screening is unnecessary. This gravel road is built on top of the graded earth, not in an excavated trench. With adobe as a binder the gravel makes an excellent road surface. Although the thickness of the gravel layer is 6 in., sufficient earth comes up to bind the gravel.

The North Loop auxiliary road starts 3 miles above Ysleta and joins the main road at Fabens. Of this 22-mile route 17 miles consist of a 9-ft. strip of machine-mixed asphalt macadam laid on a 3- to 4-in. base of gravel, crushed rock or slag, put down 5 years ago. The remainder is gravel placed 3 years ago. The latter is in good condition, and the macadam for the 10 miles farthest down the valley, where traffic is lightest, is in fair condition, but it was patched last fall. In many places nearly one-half of the area appears to be covered with the mastic used. The remaining 7-mile stretch was considered too far gone for patching and the operations of a grader and drag on the sides this spring made a smooth road for the traffic. It is proposed to scarify the macadam, regrade and add gravel, a 100-ft. length picked up by hand indicating that the asphalt still remaining in the old macadam will be an efficient binder for the gravel.

The man who was county surveyor at the time the road was built is of the opinion that the failure was due to improper proportioning. Mr. White believes that this is true to a certain extent, but that the main causes are the increased weight and speed of vehicles.

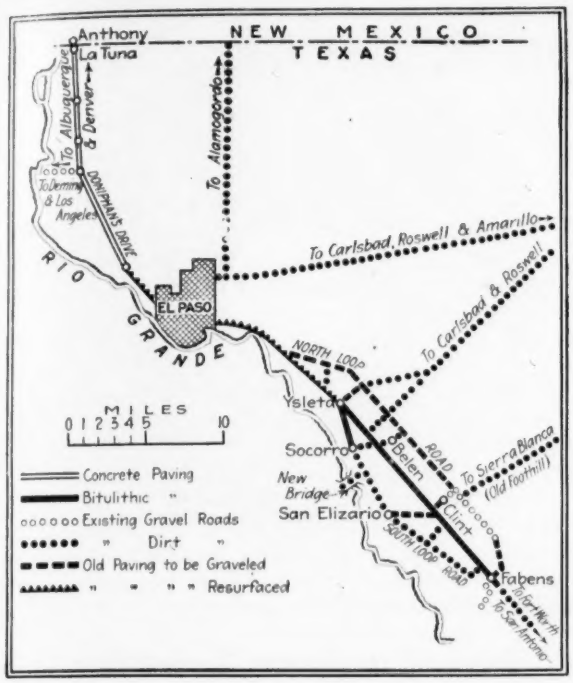
The North Loop road was built on a new right of way, the land being acquired mostly by donation. It shows remarkably little settlement, although virtually the whole length is graded up from 2 to 3 ft. above the extremely level surface of the valley. Development of the land near the foothills has followed the road, as there is now sufficient irrigation water to cover this area. The residents hold that the pavement was a good investment, considering that it raised the price of the land $30 to $50 per acre.

The South Loop road skirts the river and is simply a graded earth road on which gravel will be hauled when the county funds become available. As the haul from the foothills will be too great, the engineer proposes to load gravel onto cars up the valley, ship by rail to convenient stations and distribute with motor trucks and trailers. Much work of widening and maintaining shoulders on the main road must also be done with gravel. This work will keep the trucks busy hauling in wet weather over existing pavements.

A connection to the South Loop road from an island in the river at San Elizario, by a bridge having five 50-ft. spans, is being made. This will permit the owners of 30,000 acres of wheat land to get to El Paso without going 8 miles south to the Fabens bridge and back again. Sixty-foot piles are required, as scouring to depths of 35 ft. washes out shorter lengths. Materials encountered are silt and quicksand, except a thin layer of bowlders at a depth of 30 ft. The piles are creosoted by the Long-Bell Lumber Co., and are driven from suspended leads 52 ft. ahead of the derrick, which has an extended base counterweighted at the back end. The boom is 85 ft. long and the leads are built in sections bolted together, permitting the lead length to be extended as desired. The silt near the river makes poor road material, but a layer of yellow clay, from which a desirable top dressing was applied to the silt, was found in a borrow pit.

Doniphan's Drive on the Borderland Route, the highway to the north and west, is paved for 15 miles with concrete, the first laid in this section of the state. It is 18 ft. wide, 5 in. thick on the sides, 7 in. in the center and has a level base. Expansion joints of ⅜-in. Elastite are placed every 30 ft. The concrete was cured under water for 2 weeks. At first an earth cover of only 1 in. was placed, but it was found that the hose used in turning in the water washed off the earth unless a 2-in. depth was put on.

Maintenance for five years is guaranteed by the Southwestern Cement Co., as this is the guarantee exacted from the bitulithic contractors. The work was completed last fall under two contracts on a strictly unit basis for scarifying the old poured macadam, for grading, for rolling, for the culverts and for the slabs. The price for the slab only was 90 and 97c. for the 7- and 8-mile contracts respectively, based on $1.40 cement.



EL PASO COUNTY'S GOOD ROADS SERVE THE IRRIGATED AREAS

No cracking is in evidence beyond longitudinal cracks near the middle of the slab on a section of about 500 ft., where the old narrow strip of macadam probably was not scarified deeply enough to get the pressures equalized. These have opened less than ¼-in. and are to be filled with mastic this fall.

Two batteries of heavy artillery returning from a practice "hike" ran over a day's work 18 hours old. Though the weight of the eight 4.7-in. guns is 2½ tons, little damage was done beyond pushing a few large stones in the earth cover into the concrete and leaving wheel tracks less than ½ in. deep. The holes and marks were filled with mastic after the concrete had set and can barely be located now. On another occasion the captain of a train of 26 trucks coming from Columbus, N. M., insisted on plowing through concrete 16 hours old and a small stretch just laid. The older concrete was not injured and the latter had not yet set.

At the end of the concrete road the highway is graveled for 22 miles to Las Cruces, N. M. The work was done in 1912 and the road needs repair now, many raveled holes and uneven places being in evidence.

Sources of revenue for maintenance and construction in the county are a 15c. tax on every $100 valuation and automobile license, money, amounting altogether to $95,000 a year. For the 50 miles of hard road the county issued $350,000 of 4% bonds and about $200,000 of 6% scrip payable in seven years. No other bond issues are contemplated but some may be needed for a drainage project to keep water from the mountains from flooding the city and washing out many streets in county areas adjacent to El Paso. Damage to roads has been heavy during the past season and the road engineer proposes that a series of small dams be built in the canyons above the city similar to those proposed by the Los Angeles Flood Commission.

Run-Off Records for Two Sewerage Areas Show Contrasts

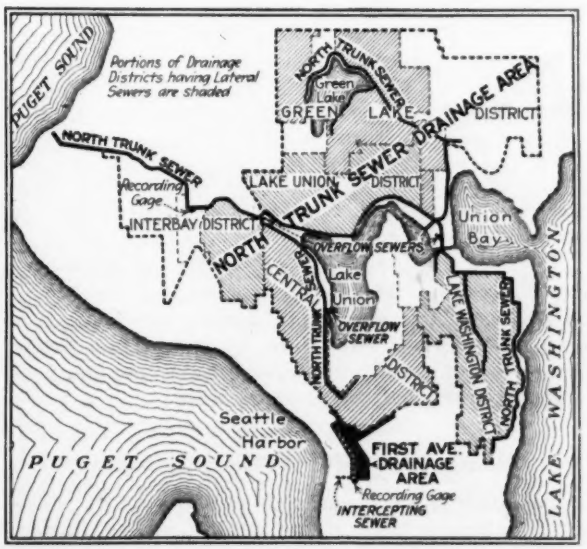
Heavy Rainfall at Seattle Followed by Running Time of 20 Minutes in One Area and 160 Minutes in Another

BY H. D. SILLIMAN
Assistant Engineer in Charge of Sewer Design, Seattle, Wash.

THERE occurred at Seattle, Wash., on June 23, 1917, the greatest intensity of rainfall ever recorded by the local U. S. Weather Bureau Station. The rainfall for five minutes, 7:10 to 7:15 p.m., was 0.23 in. and for 25 min., 7:05 to 7:30 p.m., it was 0.59 in.

The run-off from two drainage areas affords an interesting study. One area is small and highly developed; the other area is large, with a widely varying development, from paved districts, well built up, to sparsely settled urban districts. The charts from the recording gages show the depth of flow in the trunk sewers, the rates of rainfall in five-minute intervals for the period of greatest intensity of rainfall and in hour intervals for the entire day; and also the diameters and rates of grade of the trunk sewers.

The run-off from the First Ave. drainage area is remarkably quick. This area is 85% impervious. The running time in the sewers from the recording gage to the farthest removed storm-water inlet is 20 min. Complete details as to the sewerage of this district were shown on a map published in *Engineering News*, Oct. 28, 1915, p. 832. The maximum run-off, calculated from the hydraulic gradient at the time of greatest discharge from the trunk sewer, is approximately 98 cu.ft.

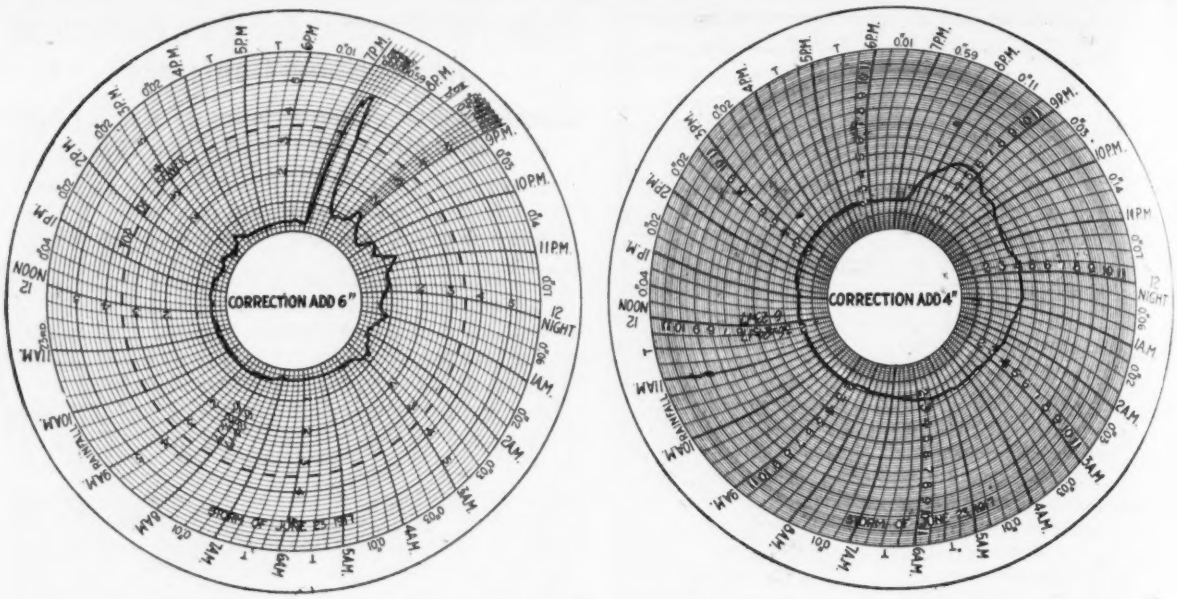


THE SMALL DRAINAGE DISTRICT IS CLOSELY BUILT UP AND THE LARGE ONE BUT PARTLY BUILT UPON

The portions of each district having lateral sewers are shaded

First Avenue intercepting sewer: Circular, 48 in. diameter. Grade, 0.385%. Estimated population, 26,000. Storm-water inlets, estimated 273. Pavement and sidewalk area, 71.7 acres. Built-over area, 61.3 acres. Vacant and unpaved area, 23.4 acres. Total contributing area above recording gage, 156.4 acres.

North trunk sewer, interbay district: Circular, 138 in. diameter. Grade, 0.035%. Estimated population, 90,000. Storm-water inlets, estimated, 8250. Lateral sewers, 1,056,500 lin.ft. Trunk sewer, 18.25 miles. Total contributing area above recording gage, 6070 acres



FLOW IN TWO SEATTLE TRUNK SEWERS WAS DIFFERENT AFTER HEAVY RAINFALL

per second. This amount is 37% of the average rainfall over the area of 156.4 acres for the time from 7:05 to 7:15 p.m.

The run-off from the drainage area of the North trunk sewer is not easy to analyze, because of its topographic features and the varying development in the five subdivisions or districts tributary to the trunk sewer. Some idea of the impervious area of each of the five districts may be obtained by a comparison of the area having lateral sewers with the miles of paved streets. This is shown in the following tabulation:

District	Area Having Lateral Sewers Acres	Paved Streets Miles
Green Lake	1,630	10
Lake Union	1,220	10
Lake Washington	1,180	12
Central	1,450	38
Interbay	590	7

The running time in the sewers from the recording gage to the farthest removed storm-water inlets is about 2 hours 40 minutes.

The period of greatest intensity of the storm was only 25 minutes. The storm came from the north with an average wind velocity of 11 miles per hour. The drainage area is 6 miles from north to south, so the storm was not of sufficient duration to fill the sewers, as is shown clearly by the run-off recorded.

Branch Road Office at Florida University

The State Road Department of Florida has established a branch office at the College of Engineering, University of Florida. Besides serving as headquarters for the work of the department throughout eastern and southern Florida, this branch office will have charge of all the testing of road material for the department. The testing equipment belonging to the College of Engineering will be used, and for the further development of this laboratory the State Road Department and College of Engineering will combine their efforts.

Helps Oil-Distributing Truck Driver to Gage Correct Amount

By E. Earl Glass
Los Angeles County, California, Road Department

IN APPLYING road oil it is most difficult for the driver of a distributing truck to know whether or not he is obtaining the correct gallonage per sq.yd. unless distance stakes have been set out by the surveyor. If, however, a copy of the accompanying chart is put under glass where the driver can see it as easily as he can the trip indicator of the odometer, which has been marked to hundredths, a ready means is furnished to him for checking up the rate of distribution.

As an example: 1080 gal., or one load, of asphaltic oil is to be applied at the rate of $\frac{3}{4}$ gal. per sq.yd. on a concrete pavement in an 8-ft. strip. By referring to

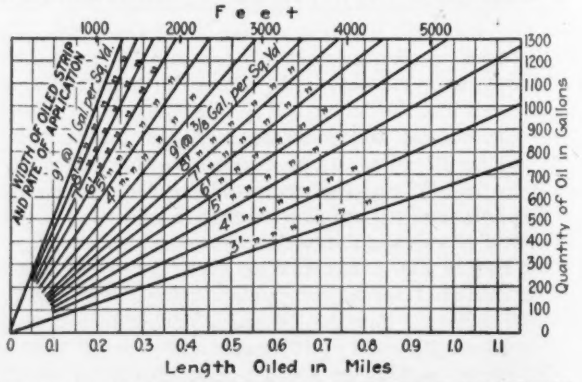


CHART IS MOUNTED UNDER GLASS IN SIGHT OF DRIVER

the chart it will be seen that 1080 gal. will oil an 8-ft. strip for a distance of 0.615 mile. If the trip meter reads 71.24 at the start, it should read 71.855 when the tank is empty.

It should be noted, however, that if the front tires are worn badly the indications will show the metered distance longer than it actually is.

St. Paul Concrete Reservoir Has Unique Side-Wall Design

Hollow Gravity Wall Section Similar to That Used in Dam—Specifications Control Construction Features—Twisted Steel Reinforcement Barred

By W. N. Jones

Formerly Designing Engineer, Bureau of Water, St. Paul; now Engineer of Design and Construction, Filter Plant, Minneapolis

As PART of the enlargement of the water-supply of the City of St. Paul, Minn., work has recently been started on a new high-service reservoir in which some novelties in the use of reinforced concrete have been applied. The main new feature of the design is the use of the inclined deck wall for the side walls, and the novelties in construction are mostly found in certain restrictions as to methods of work decided upon after consideration of some recent discussions of concrete construction in technical societies and press.

The structure surrounds an approximately square area alongside of the present high-service reservoir and is so located as to permit an extension of equal size to be made when required in the future. It is 452 x 425 ft. in plan and will hold water to a depth of 24 ft., having a capacity of 30,000,000 gal. The structural elements are a groined-arch floor, columns carrying a groined-arch roof, and the hollow wall surrounding three sides and an intermediate wall where the future extension is to be. The material is reinforced concrete, and the walls are to be backed on the outside with earth embankment.

All walls were designed to withstand any and all stress to which they might be subjected under the maximum working conditions with the reservoir full and empty, no reliance whatsoever being placed upon the earth embankments. Sufficient steel was placed on the inside face of the walls to withstand a hydrostatic pressure on the outside equal to that caused by a head of water of a depth equal to that of the point in question below the flow line. It was assumed that some leakage might take place; and as a clayey material is specified to be used for embankments which would more than likely hold back the water, this condition would hold true and would give the maximum stresses that could obtain upon the section being considered, especially when the reservoir was emptied.

In designing the outside walls a great many types, especially of the gravity and buttress and counterfoot types, were investigated, both as to stability of the structure and as to cost of construction. At first it appeared, on account of the heavy thrust of the arches and the water combined, that only a gravity type of wall would answer the purpose, but further investigations led to the type finally adopted and illustrated. This type, when full, depends partially upon the weight of the water upon it for stability, while the large heavy concrete beam at the top transfers the arch thrust into the buttresses and thence into the footings, where, by means of a concrete slab heavily reinforced, the load is distributed over the ground surface in such a manner as to prevent any overloading of the earth below.

Care was taken to prevent sliding of the walls on the clay by reinforced beams dropped well below the lower surface of the concrete slab; and to prevent sliding of the buttresses and walls upon the concrete base slab, the latter was designed with notches or depressions at frequent intervals so that, before sliding could occur, the tongues of the buttresses and wall slabs would have to shear off. No dependence was placed upon the resistance offered by the earthen embankments to the sliding.

A design was made of the center dividing wall with the same general features embodied therein as the outside walls, but with this difference, the buttresses had a concrete slab of equal strength on both sides. The design seemed to answer the purpose very well as far as strength and stability were concerned, but upon estimating the cost of the wall it was considered much too expensive. Further studies were then made; and a cantilever gravity wall, as shown in the drawings, was found to fulfill all conditions satisfactorily and to be much cheaper to construct. As in the outside walls, this wall depends also upon the weight of water directly over it for a portion of its stability. Provisions against sliding were also made by dropping a tongue below the bottom plane of the base, and the top was enlarged and well reinforced to care for all arch thrust whenever the earthen embankments were removed.

Clay Blanket Under Floor

As test pits showed the ground at the elevation of the proposed foundations to be largely composed of sand and gravel and very pervious, it was deemed advisable to excavate below grade and backfill to the desired elevation with some impervious material. A poor grade of concrete as a double bottom was at first considered, but was abandoned on account of its cost. Experiments were then conducted on clay containing about 50% of sand and gravel by making vessels of the same, allowing them to partially dry out and then filling with water and allowing to stand protected from the heat for a number of days. This clayey material with more or less sand and gravel seemed to answer the purpose; and as there were large quantities available, it was decided to form a blanket underneath the foundations of this material by placing it in 6-in. layers and then sprinkling and rolling the same into a compact and homogeneous mass with a heavy roller. The estimated cost of doing this was very much less than if a lean mixture of concrete of about one-quarter the thickness had been used. As a further precaution against leakage, wooden strips were designed to be placed between all construction joints in the foundations, and a special copper and asphalt joint was designed for use in the sloping walls of the basin.

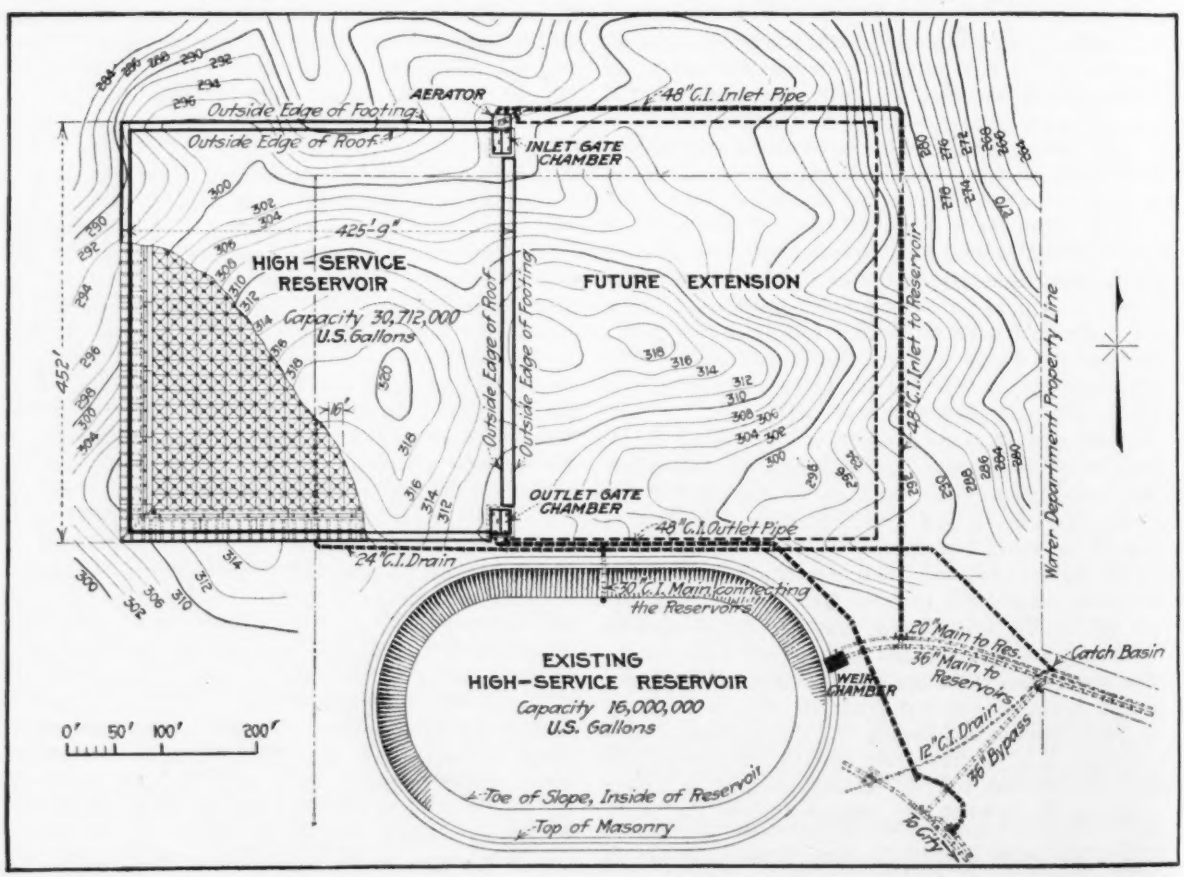
Inverted groined arches are to be placed for the column footings, and groined arches with depressions in the top are to form the roof of the structure. These

were adopted on account of the freedom from air pockets, ease of construction and low estimated costs based upon extended experience upon similar structures. All depressions in the tops of the groined-arch vaulting are to be filled with a clayey earth which is also to cover the entire roof to a depth of 21 in. above the crown of the arches, and upon this is to be spread a 3-in. layer of loam suitable for the growth of grass and shrubbery. It is expected that the clayey covering will act to prevent the rain water from finding its way down between the cracks and openings in the concrete arches into the reservoir and that the slopes as shown will carry off all water satisfactorily. The covering will also act to prevent excessive freezing of the water below, but 24 in. of earth is not sufficient to keep the reservoir entirely free from ice during long periods of extreme cold, as past experience in this vicinity with this amount of covering has demonstrated that one may expect about ¾ in. of ice to form on the surface of the water during certain times of the winter.

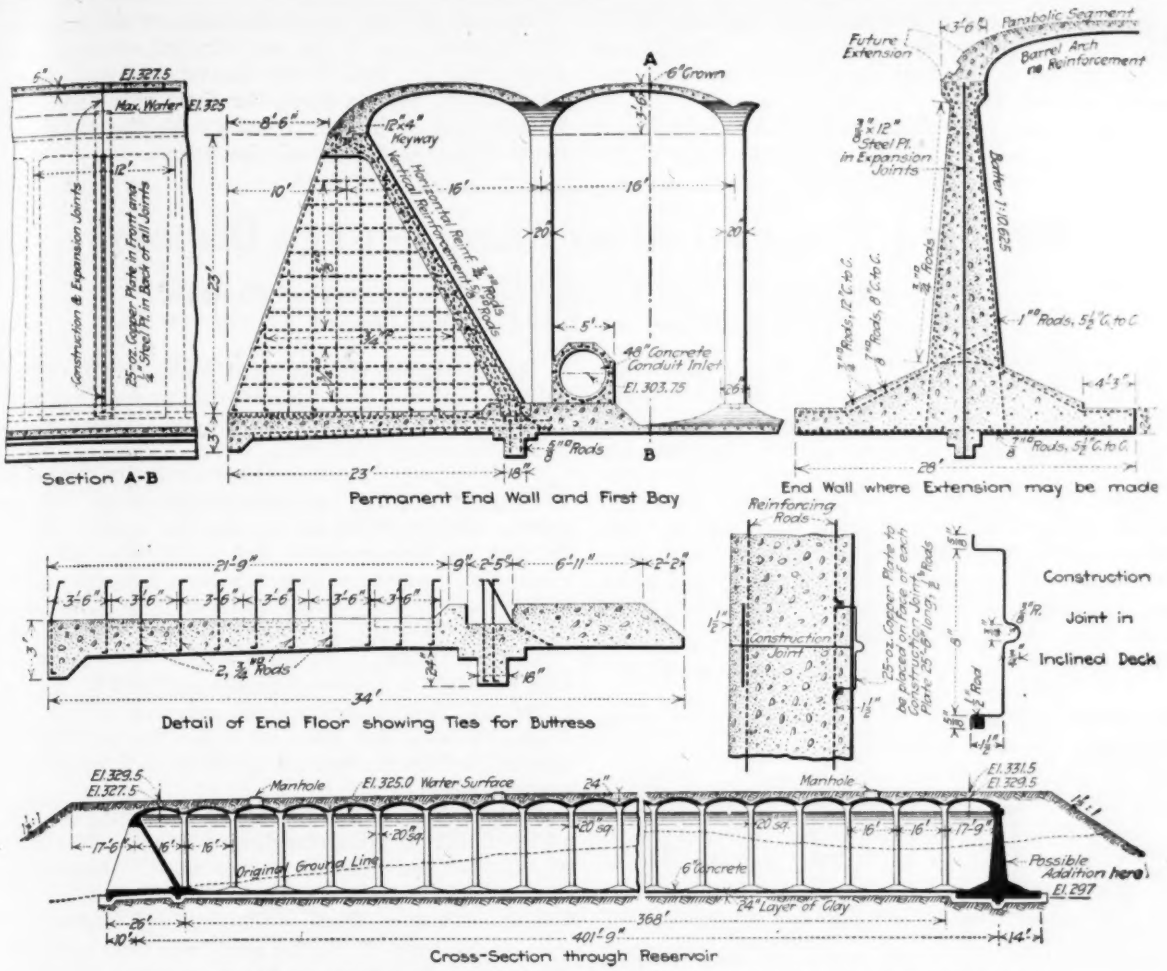
The clay embankments were therefore designed to act not only as a dam for preventing any leakage getting away wherever the same might occur, but also for protecting the structure from the extreme and sudden changes in temperature which occur in this district, to prevent freezing of the water during the cold of winter and to act as the support for a roadway around the top of the reservoir. The top covering, besides serving for protection, is intended to be composed of such materials as are suitable for the growth of vegetation so that the top of the structure will resemble a lawn, once it is well planted and taken care of.

All steel rods must be deformed, but not square twisted, the square twisted rods being thrown out on account of the results obtained in a series of tests carried on under the direction of Prof. A. N. Talbot at the Engineering Experimental Station, University of Illinois, a number of years ago, the results of which were considered of sufficient importance to condemn this type of bar for use in this structure. Plain rods were not considered, although cheaper on account of the manner in which this work might be done. St. Paul does most of its large construction work by contract, and the city charter compels the contract to be let to the lowest responsible bidder, with no provision of just how the contractor's responsibility is to be determined. Thus there is no assurance that a contractor who was able to and would perform the work absolutely right would get the work, and the bond strength was considered of great importance—therefore, the desire for some positive mechanical bond as well as the chemical bond of the rods which could only be obtained by a deformed bar of some kind.

The conduits were designed to permit uniform flow across the entire basin from one side to the other and to prevent any dead spaces. This is to be accomplished by using smaller openings from and into the conduits near the gate chambers. But whether the desired results will be obtained by this design remains to be seen. It seemed to be worth a trial, at least; and if



NEW HIGH-SERVICE RESERVOIR FOR ST. PAUL A SQUARE CONCRETE STRUCTURE ALONGSIDE OLD RESERVOIR



RESERVOIR HAS GROINED-ARCH ROOF WITH HOLLOW GRAVITY WALLS ON THREE SIDES

the results are not satisfactory, the openings can be easily changed at no great expense.

Both gate chambers were designed to care for an additional reservoir of equal capacity, and sufficient gates were placed therein to meet every and all demands of flexibility of operation when the additional reservoir is built and put in operation.

No waterproofing of any kind is contemplated to be used in any place on the structure, as from experience on similar works it has been found unnecessary. The concrete, if properly mixed and placed, will give satisfactory results with the 1:2:4 proportions as specified. However, the specifications call for an impervious wall such as should be expected of first-class work, and the contractor must guarantee the work to be reasonably water-tight under working conditions. Should this not be true, he is required to go over the entire surface which is not satisfactory with a cement-gun and place thereon sufficient mortar by this method to satisfy the conditions of the specifications.

It is only natural for anyone doing concrete work to mix and place it as fast as possible, paying very little attention to quality unless the same is insisted upon by the party in charge of the construction work. The specifications have been so drawn that no batch of concrete shall be placed in the work that has not remained in the drum of the mixer at least 1½ min. while the same was running at its normal rate of speed. No spouting of the concrete is allowed excepting such as is absolutely necessary to fill the forms in the usual way from the top, and a proper consistency of each batch is demanded in every case.

Full information for prospective bidders was embodied in the specifications. Test pits were dug whenever and wherever the bidder wished, and samples of the material encountered were taken at every foot of depth the said pits were dug and placed in properly labeled bottles and kept for reference in the office. Information as to railroad sidings and the cost of building sidings to the site was supplied the bidders whenever desired. Available sites for obtaining the clayey material for the blanket and embankments were noted, and analysis of the material made and the bidder informed of the percentage of clay in each with the depth of the material and probable extent of the same; other information relative to sand and gravel pits, location of stone quarries, methods employed in handling similar work on other structures and any other reasonable information were supplied the bidders upon request.

All quantities of various types and kinds were carefully figured and checked and supplied with each

specification in order that no one in making up his bid would have to figure the quantities or classification or be put to any expense or trouble other than was absolutely necessary.

G. O. House is general superintendent of the Water Department. The writer was in direct charge of the design and specifications of the structure and was very ably assisted by J. W. Kelsey, principal assistant engineer of the St. Paul Water Department, and others, all of whom deserve credit for their able assistance. The contract is being carried out by the George J. Grant Construction Co., of Minneapolis.

Standard Plans for Army Camp Sewage Disposal

Single-Story Baffled Septic Tanks, Trickling Filters, Intermittent Sand Filters and Chlorination Employed as Local Conditions Demand

A SINGLE-STORY septic tank of new design has been developed for the sewage-disposal systems of the training camps for the American armies. It has been called by its designer, Capt. L. S. Doten, the sanitary engineer of the office of the Quartermaster General, Washington, a "flotation" type. It is believed by Captain Doten and his associates that this tank is suited better to dispose of the very fresh sewage of these camps than the two-story type with which the army has experienced trouble from foaming; it has been found to remove suspended solids more effectively than the plain sedimentation tank, and it can be built in half the time and at one-third of the cost. The effluent is as readily handled by trickling filters as that from any other tank.

The accompanying sketches show the design for a typical divisional camp (accommodating 40,000 men or more). The appended table shows the ways in which the tank has been employed, and where it has not been used. Chlorination has generally been the final method of treatment of the effluent. In all of these cases liquid chlorine is the agent, experiment determining the dose.

SEWAGE DISPOSAL AT NATIONAL ARMY CAMPS

	Treatment	Outlet
Camp Devens, Ayer, Mass.	Raw sewage pumped to intermittent sand filters	Effluent to Nashua River
Camp Upton, Yaphank, N. Y.	Septic tanks and intermittent sand filters	
Camp Dix, Wrightstown, N. J.	Septic tank and sprinkling filters	
Camp Meade, Annapolis Junction, Md.	Septic tank and chlorination	Effluent to Patuxent River
Camp Lee, Petersburg, Va.	Septic tank and chlorination	Effluent to river
Camp Jackson, Columbia, S. C.	Septic tank and chlorination	Effluent to river
Camp Gordon, Atlanta, Ga.	Septic tank, trickling filters and settling basins	Effluent to creek
Camp Sherman, Chillicothe, O.	Septic tank, chlorination and sedimentation tank	Effluent to Scioto River
Camp Zachary Taylor, Louisville, Ky.	None	Raw sewage discharged into city sewer system
Camp Custer, Battle Creek, Mich.	Septic tank and chlorination	Effluent to river
Camp Grant, Rockford, Ill.	None	Raw sewage discharged into river
Camp Pike, Little Rock, Ark.	Septic tanks, trickling filters, settling tanks and chlorination	Effluent to small creek, dry part of year
Camp Dodge, Des Moines, Ia.	None	Raw sewage discharged into Des Moines River
Camp Funston, Fort Riley, Kan.	None	Raw sewage pumped over levee into Kansas River
Camp Travis, Fort Houston, San Antonio, Tex.	None	Raw sewage discharged into city sewerage system
Camp Lewis, American Lake, Wash.	None	Raw sewage discharged into Puget Sound
	National Guard Camps	
Camp Bowie, Fort Worth, Tex.	None	Sewerage lines for removal of kitchen and shower-bath water
Camp Kearny, Linda Vista, Cal.	Complete sewerage, septic tank and chlorination	Effluent to small creek, generally dry
Camp Mills, Mineola, N. Y.	None	Sewers lead to tidewater
	Embarkation Camps	
Camp Merritt, Tenafly, N. J.	Septic tank, sprinkling filters, sludge-drying beds	
	Officers' Training Camps	
Plattsburgh, N. Y.	None	Post sewer system discharges into Lake Champlain
Fort Niagara, N. Y.	None	Post sewer system discharges into lake
Fort Myer, Va.	Small septic tank and sprinkling filters	Effluent to brook
Fort Oglethorpe, Ga.	Septic tanks and sprinkling filters	Effluent to creeks
Fort Harrison, Ind.	Septic tanks and trickling filters	Effluent to creek
Fort Sheridan, Ill.	Septic tank and sprinkling filter	Effluent to Lake Michigan
Leon Springs, Tex.	Pit latrines, and evaporation pans for kitchen water	
Fort Snelling, Minn.	None	Post sewerage system
Presidio of San Francisco, Cal.	None	San Francisco Bay
American University, D. C.	None	Washington sewerage system
Belvoir, Va.	Pit latrines and sewerage	To Potomac River
Monmouth Park, N. J.	Septic tank and chlorination	Effluent to Shrewsbury River

At Wrightstown, N. J., where concrete materials were hard to obtain, a wooden tank was authorized. It was intended at first to employ broad irrigation here as the disposal scheme, but the sand areas were not found adapted for that or even for intermittent filters taking the tank effluent.

At Ayer, Mass., the raw sewage is pumped through an 80-ft. lift to intermittent sand filters. This plan was adopted there because it conformed to state practice, seemed to be preferred by the State Board of Health and was as cheap as the tank and trickling filter. At Yaphank, N. Y., the conditions were much the same; but as the sand there was finer, it was decided to reduce the load on the filters by a preliminary tank treatment.

Grit Chambers Sometimes Used

The grit chamber shown in the drawings was intended for use where there was likely to be considerable inorganic matter carried by the sewage. In some cases, the grit chamber has been built outside the main tanks (as at Battle Creek, Mich., and Tenafly, N. J.).

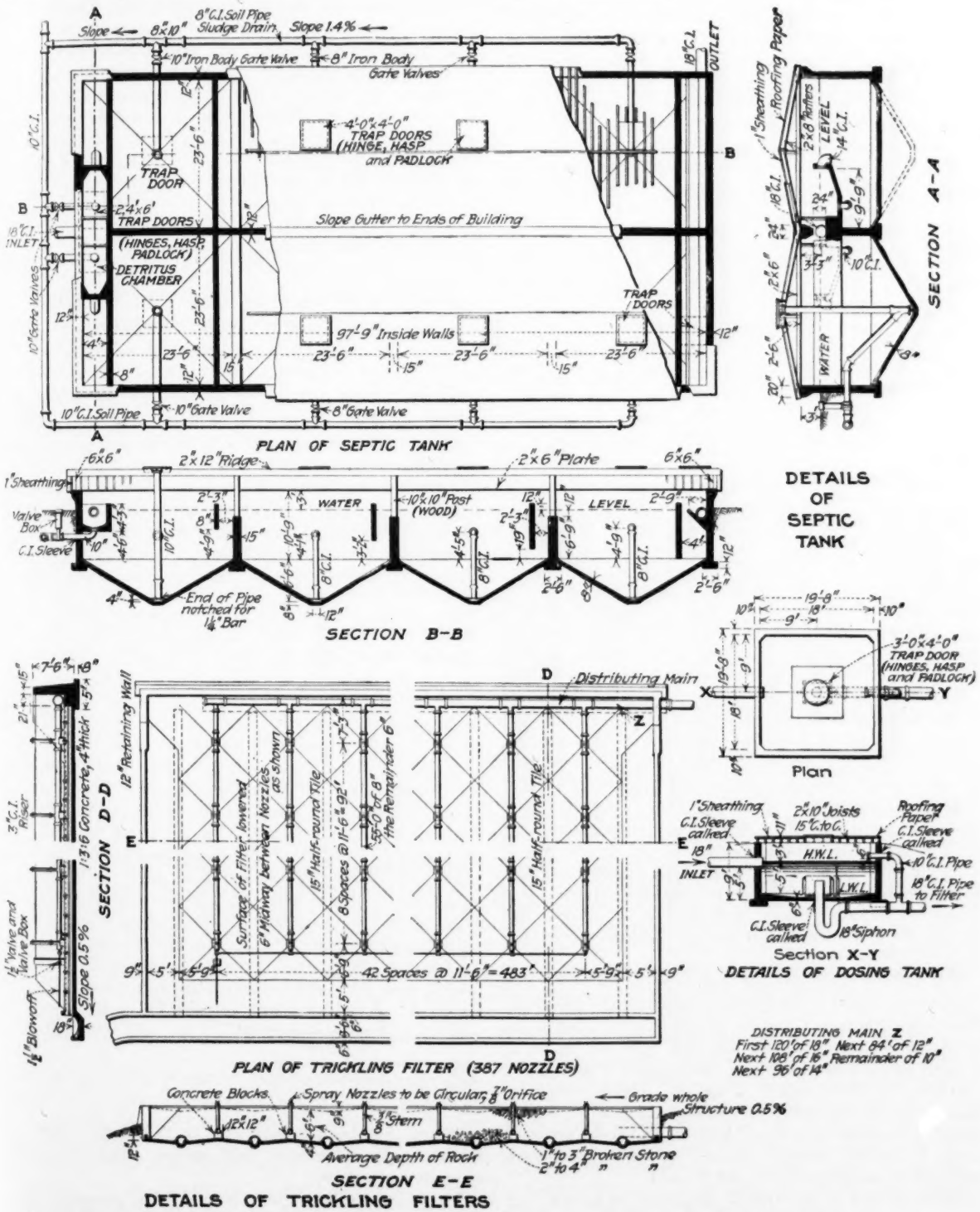
In the event of a camp being unoccupied in winter, the distributing pipe of a filter would be drained to avoid freezing. Even should a camp be occupied, the valve on the blow-off line would be left partially open in cold weather, so that the risers might not be injured during the night when discharges from the siphon chamber would be infrequent.

The sludge drawn from the smaller tanks of the flotation type, which have been in operation the longest, has been well digested and nearly odorless. The disposal of the sludge from these tanks is more or less still an open question. On account of the expense, complete drying beds will not be used at first except in a few cases, as at Tenafly, N. J. The usual scheme will be to bury the sludge in trenches.

The sizes of the disposal works, and of the trunk sewers as well, were determined with some difficulty. With any reasonable assumption of flow from fixtures,

the water mains and sewers would become absurdly large if all the men in camp were allowed to use the shower baths in one period of the day. It was decided that the men of one infantry brigade should be the largest number permitted to use the shower baths at one time. For the sprinkling filters, one acre (6 ft. in depth) is required for each 30,000 persons. This gives a rate of 1,500,000 gal. per acre.

The National Guard camps, with the three exceptions noted in the appended table, are not sewered. Excreta are received in deep pits, with tight covers carrying seats. The urinal trough, which is in the same latrine building, discharges into the pit. These pits are burned out with oil every day. Kitchen waste water is evaporated; each company's garbage incinerator has two pans for this service.



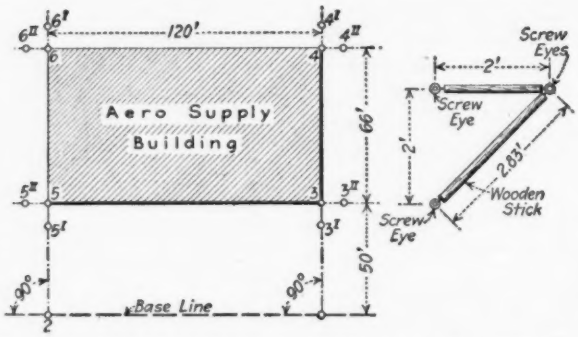
IN ARMY CAMPS USUALLY SINGLE-STORY SEPTIC TANKS AND TRICKLING FILTERS WERE USED . .

Staking Buildings at Aviation Field Was Much Simplified

By J. E. Smith
Assistant Professor of Civil Engineering, University of Illinois.

THE SURVEYING for the buildings at the U. S. Aviation Field at Rantoul, Ill., was essentially a very simple proposition, since although the buildings were of many types and sizes they were all virtually of a rectangular plan. The task was therefore simple transit and chain work, but the large number of structures to be spaced accurately and upon a moment's notice—often with many workmen waiting to begin work—offered good opportunity to devise short cuts for saving time and money.

The field at Rantoul is situated in a comparatively level country, and considerable care was exercised in



JOINED STICKS SIMPLIFY STAKING OF RECTANGULAR BUILDINGS

the choice of grade lines for the various utilities. The general building line was carried on a uniform grade of 0.2% from one end of the field to the other parallel to the grade of the main road. The large buildings and groups of smaller buildings were located so that the center of the buildings or groups would lie on the grade line.

The building lines were maintained during construction by laying off base lines parallel to the building lines. To locate a building it was then only necessary to offset from these base lines, and to drive the stake exactly at the corner of the building. However, the buildings were not all on the same building line, and piles of materials were numerous and not always placed with regard for the convenience of the engineer. Since, furthermore, the construction of adjacent buildings was begun at different times, each had to be staked out separately and one transit set up seldom served for more than one structure.

The method finally devised was about as follows: The first set-up was at some reference point on the base line, from which points 1 and 2, shown in the illustration, were established. The transit was then set up at 1, a right angle turned off, and the corners 3 and 4 set, also the 2-ft. offset points, 3′ and 4′. While little time was gained in measuring the points in this order, it was found that there was much less likelihood of error if 3 and 4 were set before 3′ and 4′. A similar procedure followed in setting 5 and 6, and 5′ and 6′.

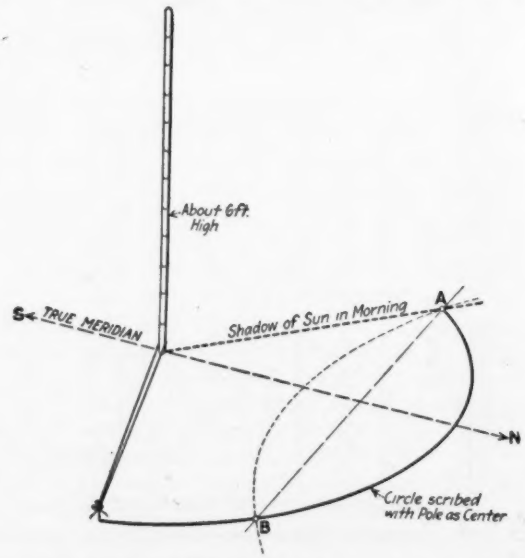
Then 3″ and 4″, 5″ and 6″ remained to be set, and after several methods involving the use of the transit had been tried the following method was developed and used with considerable satisfaction: Two sticks of convenient size were cut to such a length that after a screw-eye was affixed at each end, the difference between centers of the screw-eyes was exactly 2 ft. on one and 2.38 ft. on the other. To locate 3″, the screw-eyes in one end of the 2-ft. stick were centered over the tacks in point 3, and one of the screw-eyes in the other stick was centered over the tack on point 3′. Then when the screw-eyes in the free ends of both sticks were centered over each other they exactly located 3″.

Not only was the time of two set-ups of the transit saved, but the possibility of error through disturbing the instrument, or delay due to obstructed view, was eliminated, and the results obtained were just as accurate as when the transit was used. Forty per cent. of the time of setting up the transit was saved, and in most cases the time required to complete the staking of building was less than half of that required when the transit was used throughout the process.

High Accuracy in Determining Meridian by Means of Solar Shadows

By J. A. MacDonald
Hermanville, P. E. I.

SINCE THE ACCURACY of observations on Polaris at any hour angle depends mainly on the adjustment of the transit, and if taken at elongation the greater accuracy entails a long and tedious observation, which must frequently be made on black, cold nights, a method of making this determination by means of sun shadows should prove of interest to many engineers. The simple method proposed has been used by the writer on many occasions, and so high has been the accuracy



ALL THAT IS NEEDED IS A POLE, A PIECE OF STRING AND A BRIGHT DAY

obtained that he has been able to "check-in" with all necessary precision with field parties using the more common method.

Two or three hours before noon of a sunshiny day, erect a stiff, vertical pole about 6 ft. long on a flat plat

of ground. At a definite time before noon mark the extremity of the pole's shadow, as at *A* in the illustration. With a nail at the end of a piece of line looped about the bottom of the pole, describe an arc of a circle. At about the same time after noon watch for the moment when the end of the pole's shadow touches the arc at *B*. Bisect the arc, or the chord, *AB*, and this point and the base of the pole will be the true meridian.

Frost Breaks in Macadam Roads Due to Inadequate Drainage

By Frank P. Arnold
Wilmington, Del.

A STUDY of 96 places where bituminous macadam roads in Wyoming County, New York, were badly broken up during the spring of 1917 by frost boils indicate clearly that locating a road on a fill does not guarantee good drainage. The breaks studied varied from patches 5x10 ft. to stretches 200 ft. long and for the full width of the road. These holes occured in 42 different localities on four different roads, and were found in a total stretch of about 16 miles. The soil on all the roads was clay.

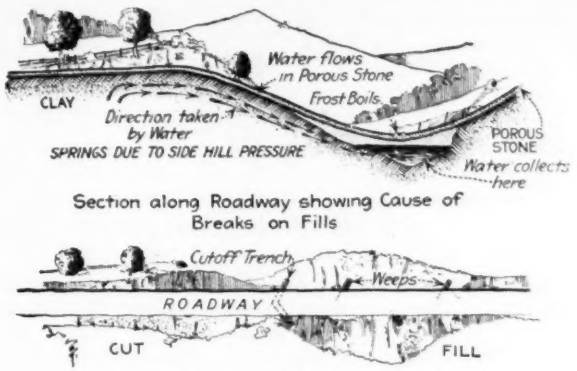
Of the 96 breaks, 57 were in fill, 17 in cut and 26 at places where there was no appreciable cut or fill. This brings out the remarkable fact that most of the breaks were on fill, and not in cut, as would be expected from a general consideration of the question. It is probable that a higher percentage of the breaks would have been in cut except that clay cuts are usually regarded as suspicious and are sub-based or underdrained more or less carefully.

Analyzing the breaks in a different manner, it was found that of the 96 studied, 45 were on a sidehill slope, nine on a grade, and 21 on both a grade and a side slope. This left only 21 which were on flat grades and slopes. The static pressure due to the sidehill slope forcing the water under the stone of the surface was the probable cause of the breaks in cut. Adequate underdrainage to lower the ground-water level would probably have prevented these breaks.

It was found that the cause of breaks on fill were mostly caused by water getting into the more or less porous bottom course in a cut at the top of a grade and flowing down through this strata to the part of the road which was on fill. Unable to get through the hard clay shoulder, this water manifested itself in a break or breaks on the fill. In one location water came from a spring in a cut at the top of the hill, ran down the hill and half way up a fill over a railroad track —a total distance of 1,000 ft. Breaks were found all the way across this fill, and when the stone was picked up and a ditch cut through the shoulder at the break furthest from the cut, a 2-in. stream of water ran for nearly a day.

A stone filled V-shaped trench, pointing up the hill and placed at the end of every clay cut, will eliminate such breaks in these locations. Furthermore, weeps should be constructed about every 50 ft. to let the water out through the hard shoulders.

Several of the breaks on fill were due to the same cause as those in cut; that is, static pressure forcing the water up under the stone. Twenty-six breaks occurred at places where the drainage was poor and water was standing in fields alongside, and other breaks were found to be due to water overflowing the road. On one 5-ft. fill ten holes occurred where the only reason apparent was poor filling material. The record showed that most of the material in the fill at this



DRAINAGE SHOULD BE PROVIDED FOR WATER WHICH COLLECTS AT FILLS

Company Housing in the United States

A paper read by Leifur Magnusson, of the U. S. Bureau of Labor, before the National Housing Conference in Chicago on Oct. 15, gives some results of a Government survey of the extent of company housing in the United States. The survey is based on investigations going back as far as 1831, and includes all projects where employers have provided residences for their employees. It was found that about sixty different companies reporting to the survey have spent about $16,000,000 on company houses, which amounts to 28% of the average annual payroll of these companies for a recent five-year period. They house 42% of their employees.

On this basis the survey decided that if an employer proposes to house one-half of his employees, he must expect to invest in houses not including an amount equal to one-third of his annual payroll. If he proposes to house all, he must invest an amount equal to two-thirds of his annual payroll; that is, the proportion which the cost of the houses forms of the payroll is to the proportion of employees housed as about 2 is to 3. Of the companies reporting, the employer gets a gross return of 8.3% on the housing investment, the figures varying from 20% on mining houses in Alabama to 6% on steel company houses in Pennsylvania.

The survey finds that the scientific development of the housing problem has not reached a very high point and that with the entry of so-called town-planning experts the results are better. Not only do layout and proper design of the housing area and of the individual house affect the financial as well as the intangible returns to the company, but proper maintenance, considering such things as the operation of a regular repair department, systematic removal of garbage, encouragement of gardening, etc., is found to be necessary.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Fifteen Years of Engineering Literature

Conceived by the Late George H. Frost, the Engineering Literature Supplement to "Engineering News" Was First Published in December, 1902. With the Assistance of 250 Contributing Reviewers, More Than 1500 Books Have Been Reviewed. The Constant Aim Has Been to Aid Purchasers in the Selection of Technical Books, to Advance Sound Engineering and to Help Raise the Technical and Literary Standards of Engineering Writing.

By M. N. Baker
Associate Editor, Engineering News-Record, and Editor of "Engineering Literature"

WITH its present number Engineering Literature completes its fifteenth year. The occasion invites a look backward.

It is eminently fitting to say at the outset that the Engineering Literature supplement to *Engineering News*—a supplement in name and in fact for some years—was the conception of the late George H. Frost, founder of *Engineering News*. He it was who decided that it should be started and that it should be put in charge of the writer as editor. The working out of the new project was left entirely to the editor and to the counsel and assistance of his editorial associates.

In 1902 the reviewing of technical books in the engineering press—and with a few exceptions the same is still true—was for the most part perfunctory in character and the time of publication of the reviews depended largely upon the exigencies of space. Most of the reviews were written by the editors. If any books were sent to outside specialists the ultimate reader was none the wiser, for the reviews were never signed.

Engineering Literature adopted a radically different practice. It provided a fixed time and place and ample space for reviews, and after its first two issues it published contributed signed reviews as well as staff notices. All this made for early, adequate and expert notice of every book on engineering and closely allied subjects. In fact, by the immediate listing of new books under "Publications Received," provided they could not be reviewed in the issue following their publication, the appearance of each new book was made a matter of news.

The original plan and scope of Engineering Literature was outlined with deliberate care in the first number, which appeared Dec. 18, 1902. As the program then announced has been faithfully adhered to in its essential features and in most of its minor details since and still serves the editor as a guide, it is reprinted in full:

Why Established—Books and other publications relating to engineering, the allied arts and sciences, and various public questions of the day are coming from the press so rapidly and the demand for critical estimates of their value is so great that it seems desirable to give them more extended, prompt and systematic attention than is possible in the crowded columns of the main sheet of *Engineering News*. Accordingly it has been decided to issue a supplement devoted entirely to Engineering Literature.

Its Field—Under the title named we propose to cover not only the several branches of engineering and the various arts and sciences related thereto, but also such phases of economics, sociology, municipal administration, public art, exploration, travel, biography and history as appeal particularly to the readers of *Engineering News*. This supplement will be published with an issue of *Engineering News* about the middle of each month, and all subjects requiring more prompt attention will continue to receive it in our regular weekly issue.

Its Method and Aim—The supplement will include reviews and critical notes, announcements of new and forthcoming publications, letters from readers, answers to inquiries, and editorial comments and discussions. Its aim will be to convey prompt and critical information regarding the class of literature already mentioned, and to raise the technical and literary standards of all such publications.

First Aid to Book Buyers—The primary object of the book reviews will be to aid interested persons in deciding whether or not it is worth while to add a given new book to their library. To this end an attempt will be made to give a comprehensive idea of the contents of each volume reviewed, and to indicate its value as a contribution to the literature of the particular subject involved. Such an estimate demands a consideration of the character and scope of each book, both independently and in its relation to other works on the same subject. A possible purchaser who has no book on the subject treated wants to know how complete and authoritative the latest publication is, and in what respect it is superior or inferior to others covering the same field. The man with a well-stocked library, on the other hand, wishes to be informed whether it is worth while to add the new volume to his collection.

To Promote Technical Quality and Literary Excellence—Next in importance to conveying an idea of the contents of a book and their relation to other publications is the consideration of the way in which the subject matter has been presented. This includes both the arrangement of the several parts in relation to each other and the clearness and general style of the language employed. In other words, literary excellence is an essential quality to the best technical, as well as other, writing. This fact has been altogether too generally ignored in the past, but must be borne in mind hereafter by both authors and publishers. In fact, some of the latter are already insisting upon it, as not a few authors have found to their sorrow.

Critical Opinions from Book Readers Sought—Letters criticising engineering literature, with a view to improving its quality, will be welcomed in the columns of the supplement. In fact, it is hoped that they may become one of its most valuable features, since the opinions of those who have read or used a book ought to show both its faults and its merits, and thus serve as a most valuable guide to authors and publishers. The inquiries and answers thereto will necessarily be limited to information not generally known or readily available, and which bids fair to be of interest or value to others besides the inquirers.

Will Point Out Defects and Gaps in Engineering Literature—Editorial comments and discussions will naturally relate to various topics suggested by books under review, and it is hoped that they, like the letters from readers, may also include criticisms of literature both old and new, and particularly references to the gaps in engineering literature. That there are many such gaps engineers well know. Doubtless they would be filled more rapidly if only their presence were more frequently and strongly emphasized by discriminating readers and editors. On the other hand, some fields are already so well covered that it would be well if authors could be directed elsewhere.

Some Advantages—Some of the advantages which we trust will result from the publication of this supplement, as compared with our previous efforts to deal with engineering literature, are more space for book reviews, a wider range of topics covered, increased care in the preparation of reviews, and the virtual addition of two new features: Letters from the readers and users of books, and editorial surveys of engineering literature.

To Advance Engineering Science and Literature—Finally, we hope that with the coöperation of the readers of the supplement and of both authors and publishers, we may eventually do for engineering and other technical books what the best of the literary weeklies and monthlies are doing so well for general literature, thus contributing somewhat to the advance of engineering and the allied arts and sciences, and to the sound development of the literature thereof.

Appreciated and Supported from the Start

That Engineering Literature filled a large want was shown by the reception given its earliest numbers and from the appreciation and support which have been extended to it from that time to this. Surveying the field of engineering literature with promptness, regularity and a never-failing attempt at fairness, it has afforded a guide to would-be purchasers. Letters to the editor show that both individuals and libraries await its reviews before purchasing. On this account, care has been exercised in indicating the scope and the character of each volume and in valuing it as a contribution to the literature of engineering.

Parallel with service to book buyers has been the aim to promote technical quality and literary excellence in engineering books, and to advance both engineering science and literature. Its efforts in this direction have been ably supported by many outside reviewers.

Over Fifteen Hundred Volumes Reviewed

In fifteen years, more than fifteen hundred volumes have been reviewed. This does not include reports and pamphlets, of which hundreds have been briefly noted and still other hundreds merely listed under "Publications Received." It includes chiefly books written and printed for sale. What an output! Does not the mere number suggest the need for keen analysis and unhesitating criticism at competent hands? It would be interesting and instructive to classify this vast output by subject and quality.

This leads to the statement that one of the original objects of Engineering Literature, as set forth in the announcement already quoted, was to make surveys of groups or classes of engineering books. A number of such surveys have been published. Most of the earlier ones were editorial surveys, in which one or another editor of *Engineering News* reviewed a group of books in his own special field. In more recent years like surveys have been made by readers.

If readers and users of engineering books would more often constitute themselves reviewers of groups of books or of individual books, the cause of good engineering literature and of good engineering would be promoted.

Two Hundred and Fifty Reviewers

All unsigned reviews published in these columns have been and still are the work of some member of the editorial staff of the journal of which the Engineering Literature section forms a part. In the case of some important books, and particularly of compendiums, staff reviews may be the joint production of two or three editors or of the entire editorial staff—as in the case of a new or revised edition of an engineer's handbook.

Obviously, the editors have neither the extremely specialized knowledge required for an expert opinion on each of the many and diversified books coming from the engineering press each year, nor, even if they had the knowledge, the time to review the books and perform their other editorial duties. For these reasons, outside reviewers have contributed largely to these columns. The first two numbers contained only staff reviews. Since then, rarely has a number appeared without at least one outside review.

As an indication of the care taken to fit reviewers to books and of how wide the field covered has been, it may be stated that 250 different reviewers have contributed to these columns in the past fifteen years. The list includes scores of the best-known engineers and other scientists of the country and a few foreigners—foreigners geographically, but not in spirit.

Death has claimed at least fifteen of these reviewers. Most of them were widely known, as the following list will show:

Wm. H. Bryan, Prof. Storm Bull, Prof. Charles L. Crandall, Henry Floy, Col. D. D. Gaillard, Maj. Cassius E. Gillette, E. Sherman Gould, Wilhelm Hildenbrand, Prof. Leonard P. Kinnicutt, Emil Kuichling, Col. Smith S. Leach, Geo. W. Rafter, Prof. N. S. Shaler, W. M. Stiles, W. D. Taylor.

The standard for technical books has risen in the past fifteen years. No one thing has contributed more to this desirable end than the improvement which has taken place in the teaching and in the student output of our engineering schools. With a higher quality of technical information there has been a great improvement in the character of the English used. For this also the engineering schools deserve thanks.

In Engineering Literature of Oct. 13, 1904, this question formed the opening sentence of an editorial note "To what extent should a writer on engineering subjects cultivate literary style?" After quoting from Frederic Harrison's "Early Victorian Writers," in which the author scored "the flat, ungainly, nerveless style of

mere scientific research," and cited Huxley and Tyndall as proof that this need not be, the note continued: "It would be interesting indeed to see a list of engineering writers who have a notably good literary style." Such a list would be much longer today than it would have been in 1904. Several books reviewed in these columns bear testimony to the efforts of teachers and writers to improve the literary style of engineering writings. A notable example is reviewed at length on page 937 of this issue.

It would be foolish to claim for Engineering Literature a fifteen-year monopoly in the upbuilding of technical literature. Such a claim would be all the more foolish in view of the fact that the *Engineering Record*, with which *Engineering News* was consolidated early this year, always maintained a high standard of technical literature—through all its pages as well as in its book reviews. A few years ago it began handling its book reviews more systematically than formerly and also began the practice of having outside reviewers, whose services had long been availed of, sign their reviews.

With the consolidation of the *Record* and *News*, Engineering Literature is now heir to the best that both journals accomplished for technical literature. With the help of its many collaborating reviewers, both invited and volunteer, and with the continued patience and forbearance of both authors and publishers, Engineering Literature will continue its attempt to help advance the science and the literature of engineering.

An American Engineer-Humorist

Sir—Your readers may be interested in the extracts given below, from Prof. F. L. Pattee's recently published book, entitled "A History of American Literature Since 1870." It is significant that "the real father of the new school of humorists," of those who created the "laughter of the west," was a hard-working engineer in close touch with nature and reality. The engineer is forever wrestling with the forces of nature, and reality is for him more than a philosophical term. He is, therefore, more apt to notice the exaggerated and grotesque, more apt to dissolve the incongruities and tragedies of life in an all-freeing humor. Professor Pattee says:

". . . . But the greatest of them all, the real father of the humorists, the man who gave the East the first glimpse of the California type of humor, was George Horatio Derby (1823-1861), whose sketches over the signature 'John Phoenix' began to appear in the early fifties. Undoubtedly it would amaze Derby could he return and read of himself as the father of the later school of humor. With him literary comedy was simply a means now and then of relaxation from the burdens of a strenuous profession. He had been graduated from West Point in 1846, had fought in the Mexican War, and later, as an engineer, had been intrusted by the Government with important surveys and explorations, first in the far West and then in Florida, where he died at the age of 38 of sunstroke. He was burdened all his life with heavy responsibilities and exacting demands upon his energies. He had little time for books, and his writings, what few he produced, were the result wholly of his own observations upon the picturesque life that he found about him in the West.

"Derby was the first conspicuous writer to use grotesque exaggerations deliberately and freely as a provocative of laughter. Irving and many others had made use of it, but in 'Phoenixiana' it amounts to a mannerism. He tells the most astonishing impossibilities and then naively adds: 'It is possible that the circumstances may have been slightly exaggerated. Of course, there can be no doubt of the truth of the main incidents.' . . . . So popular was the Phoenix *Herald* that 'we have now 782 Indians employed night and day in mixing adobe for the type . . .'

"The second characteristic of Derby's humor was its irreverence. To him nothing was sacred. The first practical joker, he averred, was Judas Iscariot: He *sold* his master. Arcturus, he observed, was a star 'which many years since a person named Job was asked if he could guide, and he acknowledged he couldn't do it.' . . . . He delights in the device of euphemistic statement used so freely by later humorists. . . . . He abounds in true Yankee aphorisms: 'When a man is going down, everybody lends him a kick'; 'Where impudence is wit, 'tis folly to reply.'

"It was Derby who wrote the first Pike County ballad. 'Suddenly we hear the approaching of a train from Pike County, consisting of seven families, with forty-six wagons, each drawn by thirteen oxen.' . . . . 'Now rises o'er the plains in mellifluous accents, the grand Pike County chorus:

> "Oh we'll soon be thar
> In the land of gold,
> Through the forest old,
> O'er the mounting cold,
> With spirits bold—
> Oh, we come, we come,
> And we'll soon be thar.
> Gee up, Bolly, whoo up, whoo haw!

"Not much was added to the Western humor after Derby. Mark Twain's earliest manner had much in it that smacks of 'Phoenix.' The chapters entitled 'Phoenix Takes an Affectionate Leave of San Francisco,' 'Phoenix Is on the Sea' and 'Phoenix in San Diego,' might have been taken from 'Roughing It.' Just as truly the chapters, 'Inauguration of the New Collector' and 'Return of the Collector,' 'Thrilling and Frantic Excitement Among Office Seekers,' might have been written by Orpheus C. Kerr. Yet despite such similarities, the later school did not necessarily filch from 'Phoenix'; they learned their art as he had learned it, from contact with the new West. All drew from the same model."

New York City. LEON S. MOISSEIFF.

[Unfortunately, none of the citations reveals Lieutenant Derby's humor in his own professional field, engineering. In *Engineering News* of Dec. 31, 1887, p. 469, appeared a chapter from "Phoenixiana" in the form of a report, dated Feb. 15, 1855, on a military survey for a railway from San Francisco to the Mission of Dolores. Among other equipment the party is said to have had 13 large and small theodolites and 184 solar compasses (one for each chainman, rodman, laborer, etc.). Each man was "armed with four Colt's revolvers, a Minie rifle, a copy of Colonel Benton's speech on the Pacific Railroad and a mountain howitzer," and was provided with a wheelbarrow for the transportation of

the howitzer. Each man was also supplied with "a gold chronometer watch and, by a singular mistake, a diamond pin and gold chain," the last-named furnished in carrying out instructions to supply the party with *chain and pins.*

A Memorable Survey

We cannot refrain from quoting a bit more from the report on this memorable survey:

"While crossing Market Street, being anxious to know the exact time, I concluded to determine it by observation. Having removed the Sidereal Clock from the cart, and put it in the street, we placed the cart in the plane of the Meridian, and I removed the eye and object-glass of the transit, for the purpose of wiping them. While busily engaged in this manner, an individual, whom I have reason to believe is connected with a fire company, approached, and seeing the large brazen tube of the transit pointed to the sky, mistook it for a huge speaking trumpet. Misled by this delusion, he mounted the cart, and in an awful tone of voice shouted through the transit '*Wash her, Thirteen,*' but having miscalculated the strength of his lungs, he was seized with a violent fit of coughing, and before he could be removed had completely coughed the vertical hairs out of the instrument. I was in despair at this sudden destruction of the utility of our most valuable instrument, but fortunately recollecting a gridiron, that we had among our kitchen apparatus, I directed Dr. Heavysterne to hold it up in the place of the true Meridian, and with an opera glass watched and noted by the clock the passage of the sun's center across the five bars. Having made these observations, I requested the principal computer to work them out, as I wished to ascertain the time immediately; but he replying that it would take some three months to do it, I concluded not to wait, but sent a man into the grocery, corner of Market and Second, to inquire the time, who soon returned with the desired information. It may be thought singular, that with so many gold watches in our party, we should ever be found at a loss to ascertain the time; but the fact was that I had directed every one of our employees to set his watch by Greenwich mean time, which though excellent to give one the longitude, is for ordinary purposes the meanest time that can be found. A distressing casualty that befell Dr. Bigguns on this occasion may be found worthy of record. An omnibus, passing during the time of observation, was driven carelessly near our Sidereal Clock, with which it almost came into contact. Dr. Bigguns, with a slight smile, remarked that 'the clock *was nearly run down,*' and immediately fainted away. The pursuits of science cannot be delayed by accidents of this nature, two of the workmen removed our unfortunate friend, at once, to the Orphan Asylum, where, having rung the bell, they left him on the steps and departed, and we never saw him afterwards."

The other portions of "Phoenixiana" have little to do with engineering, but deserve the praise given by Prof. Pattee.

"Phoenixiana" appeared in book form in 1855. It was republished in 1889 with an introduction by John Kendrick Bangs, but even the later edition is now out of print. Both editions were from the press of D. Appleton & Co.—Editor.]

Teaching English Composition to Engineering Students

Reviewed by Mont Schuyler
Associate Editor, Engineering News-Record

THE COMPOSITION OF TECHNICAL PAPERS—By Homer Andrew Watt, Assistant Professor of English, New York University. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 5 x 8 in.; pp. 431; $1.50.

Depending entirely upon what our individual ideas may be as to the place of the engineer in society, we choose instinctively between the extremely liberal attitude toward the teaching of English adopted by Professor Aydelotte and the more narrow conception held in many quarters where it is felt that engineers are primarily technical men and that their training should concentrate with absolute exclusiveness upon those studies which are technical—that even so liberal a thing as English composition should be taught from a purely utilitarian viewpoint.

In this, the latest book dealing with the teaching of English composition to engineering students, the author has steered what may be considered a middle course at least to this extent; he has written a book which may be used in the first year's work, or, again, it may be found quite useful in the third and fourth years of the student's college course and as supplementary to his freshman training in pure English composition.

In the first paragraph of chapter I is found the following statement, "An engineer who is inarticulate is quite as useless as one who is professionally incompetent." This thought runs through the whole book, not only between the lines but in definite statements made by the author. He recognizes "that the man who has not the power to give his ideas clearly to others, the man whose thoughts are locked in his brain simply because he has not the ability to communicate them, suffers under a handicap which no amount of professional knowledge can possibly overcome." It is with the idea of unlocking the sealed lips of so many engineering students that in his own course he takes them not only through a precise study of sentence and paragraph structure and the development of ideas, but has two weekly class meetings for informal talks on technical writing, analyses and study of specimens from various sources, and for a drill in paragraphs and sentences. Supplementing this, a weekly 500-word theme of the type under consideration at that time must be written, a semester paper of from 2000 to 3000 words on a subject of special interest to the student, and, in addition, there is a regular weekly conference of at 'least 15 minutes with each student.

But the author, nevertheless, is frank to confess that the book has been written with one aim, and one aim only—to teach engineering students to write better technical papers.

Professor Watt holds that the professional writing of an engineer is all exposition or argumentation, and while he admits that there may be places where pure narration or description may be called for or at least excused, throughout the main part of his book he concentrates attention upon the first two mentioned types of writing.

After two chapters which deal with what he considers the fundamental problems, such as the task of getting the reader's point of view and the use of mechanical de-

vices for assisting the reader, and in which he treats of certain basic principles governing the planning and writing of the whole composition, he plunges immediately into a consideration of the paragraph. The matter in this chapter is more or less in support of the thesis that the paragraph is after all a purely mechanical device intended to serve the reader rather than to add anything to the easy progress of the matter being developed. And no doubt this is a defensible and perhaps accurate conception of the paragraph in *technical* writing. In the author's opinion, the paragraph is something that can be defined closely, not only as to length but as to its position in the composition. With this attitude the reviewer does not care to quarrel, recalling, as he is forced to, that the treatment of the paragraph, as well as the other points brought out in the book, is intentionally utilitarian in character.

Throughout the chapter devoted to sentence construction there seems to flow a better and, at least to the reviewer, a more sensitive feeling. It is as if Professor Watt had more of sympathy with the sentence than with the paragraph. It must be admitted, surely, that the sentence is the higher development, though not so complex a one, of the art of writing. To quote: "Even when he [the student] has learned to avoid the pitfalls of sentence construction which are positively incorrect, he still may write sentences which are slovenly and weak, for the problem of good sentence-making is the problem not only of writing correctly but also of writing effectively. The price which must be paid for good sentences is constant vigilance and painstaking revision."

But this chapter is not a mere eulogy of the beauty of the sentence. Much space is given to mechanical structure, to the uses of punctuation, to sentence unity and to securing proper emphasis. Appended is an excellent list of sentences for analysis by the student.

In the second part of his book, Professor Watt takes up five different types of technical exposition: Technical description, exposition of processes, exposition of ideas, reports and business letters. Here the concepts developed in the first part are applied. This section constitutes by far the largest portion of the book, and though much of it consists of examples, both good and intentionally bad, these are collected with excellent care and with a due regard to the immediate interests of students.

In Professor Watt's introduction to this part, he announces as his aim the "explanation and illustration of some of the more specific principles which govern the composition of the types of exposition with which engineers are most concerned, technical description, expositions of processes, expositions of ideas, reports and business letters." But he warns the student that "the suggestions for effective writing which are here given are not to be understood as representing a body of formulæ universally applicable; they are designed to serve only as general guides." The specimens which he has selected have most of them been submitted to the test of actual class-room use, which as he admits, forces a certain necessary limitation in selection, and the elimination of all articles which are highly technical or otherwise difficult to understand from the students' limited technical experience.

The difference between artistic and technical description is indicated very clearly. The object of the technical writer is, it is definitely pointed out, the reproduction in the reader's mind of a mental image of the object under consideration, or at least of its essential features. He admits the legitimacy of the use of any device or trick which will assist the reader to this end, and dwells at considerable length upon the use of photographs and diagrams, and the use of graphic illustrations, such as comparison with the T-square or the S-hook—objects which are immediately familiar.

Emphasis is placed on the fact that a mere catalog of parts is not a description "any more than a pile of junk is a machine," and the student is made to realize that he should usually endeavor to supply a mental image of the whole object and the parts which are really essential; and that to attempt more than this is unwise, unless the description is long, detailed, and very fully illustrated. A lucid explanation is given of the value of conveying a general idea of the object or appearance of the subject before entering into a technical description of details.

The chapter on reports is well worthy of reading by anyone who has to handle this most usual and difficult type of technical writing. What Bismarck called the "weight of the imponderables"—the psychologic advantages of position, experience, and trustworthiness—is made sufficiently clear to the reader of Professor Watt's book by his quotation of the following perhaps hypothetical interview:

Superintendent: "Did y' inspect that machine?"
Engineer: "Yes, sir."
Superintendent: "Any good for our purposes?"
Engineer: "Yes, sir; we ought to have one."
Superintendent: "All right."

Professor Watt points out that here are the elements of a complete report. And, he says, it may be added that there are probably more reports of this type than of any other.

Irrigation Principles and Methods

OPERATION AND MAINTENANCE OF IRRIGATION SYSTEMS: By S. T. Harding, Assistant Professor of Irrigation, University of California, formerly Irrigation Engineer, U. S. Department of Agriculture. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 271; illustrated; $2.50.

Reviewed by ANDREW WEISS
Project Manager, U. S. Reclamation Service

This book is an excellent compilation of the fundamental principles and representative methods of the operation and maintenance of irrigation systems in the United States. The author exhibits a thorough understanding of the subject treated, evidently the result of practical experience and painstaking inquiry.

In the first chapter the subject of general maintenance is treated extensively. Statistics of costs, showing the necessary great range of figures due to local variation of conditions, are given. The subject of liability for damages is discussed in the light of current court decisions. This is followed by a complete discussion of the many perplexing problems of canal maintenance which the manager of an irrigation canal of appreciable size must be prepared to solve. The questions of priming canals, of silting and control of seepage losses and undesirable vegetation, of protection against wind erosion, burrowing animals and trespass by range stock, are given in much detail, and numerous remedies with

cost records of their application are given in ample outline.

In the second chapter the relative serviceability, length of life and needful precautionary measures in the maintenance of wooden, steel and concrete structures are discussed. This treatise is amplified by numerous cost data and description of methods sufficient to serve as a reliable guide in the operation and maintenance as well as in the planning of such works. This chapter reflects more of the mental processes of the builder than of the manager and is, therefore, of special value to the engineer or other responsible person charged with the planning and building of a new system or of extensive betterments and replacements.

The third chapter is given to the problem of organization, outlining and suggesting appropriate plans for systems of varying sizes and conditions based upon experiences so far available.

The methods of delivering irrigation water are treated fully in the fourth chapter. The author shows a close acquaintance with the various methods in use, their suitability to different conditions, and points out the gradually increasing use of some form of rotation plan. The disadvantages resulting from the so-called continuous delivery method are perhaps not sufficiently emphasized.

The measurement of irrigation water is treated exhaustively in the fifth chapter. The very complete text, clearly written, is supplemented by numerous tables derived from standard formulae for weirs and orifices, together with explanatory matter showing costs, limitations of use, and corrections to be applied to various kinds of weirs and other measuring devices. Numerous forms for water records are given, selected from well standardized systems.

A chapter of 14 pages is devoted to rules and regulations. It presents in a general way the necessity of these as well as the range and character of detail which it is advisable to cover. Telling excerpts are given from regulations in use. This subject is amplified in the appendix, which gives four complete sets of regulations from leading projects in Idaho and California.

The proper apportionment of construction and operation charges receives thorough study and analysis, and the results are well summarized in a concluding article. The reasons for the tendency toward adoption of quantity rates, as well as the necessary limitations and modifications to suit local conditions, are clearly presented, and in a manner indicating a close acquaintance with the human element involved.

The eighth chapter is devoted to a brief discussion of miscellaneous phases of irrigation operations. Most readers will wish to supplement this information by looking up the references given at its close. In a brief article on drainage he gives an outline of prevailing methods of procedure. Perhaps insufficient emphasis is given to the fact that an entire district or project is responsible for the usual seepage troubles, which consideration should lay the basis for an equal distribution of costs of relief measures.

At the close a short chapter is given to the subject of accounts, suggesting briefly a system of accounting in conformity with up-to-date practices, and in such detail as will enable the management to utilize the results of its operations in eliminating defects and increasing efficiency. Each chapter but one closes with numerous references, many of which are, however, not generally available.

This book is a timely and useful addition to the literature on irrigation practice. It presents in concentrated form a large range of information not elsewhere compiled and of special value to the student of irrigation engineering. It covers much of great value to the engineer or manager charged with construction, as well as operation and betterment, of irrigation works. The experienced manager or assistant will find it instructive, interesting and profitable, pregnant with suggestions for improvement, the need of which is doubtless very general in irrigation practice.

Reclamation Service Works Described

IRRIGATION WORKS CONSTRUCTED BY THE UNITED STATES GOVERNMENT. By Arthur Powell Davis, Chief Engineer, U. S. Reclamation Service. New York: John Wiley & Sons, Inc. London. Chapman & Hall, Limited. Cloth; 6 x 9 in.; pp. 413; illustrated. $4.50.

Within less than fifteen years after the date of the first enabling legislation, the U. S. Reclamation Service expended about $100,000,000 on the construction of numerous irrigation systems scattered over our vast western domain. In 1916 works and water were available to irrigate 1,500,000 acres and water was actually supplied to 900,000 acres. These irrigation works include some of the most notable dams in the world, both in design and height, including the highest of all—the Arrowrock, near Boise, Ida., a masonry structure 354 ft. high from lowest foundation to parapet crest. Tunnels, pressure conduits, flumes, headgates, drops, main and lateral canals, pumping stations, hydro-electric plants, and other irrigation works in great variety of design and material abound.

With the aid of well chosen line drawings and halftones, Arthur P. Davis, chief engineer of the U. S. Reclamation Service, has systematically and concisely described 21 of the 25 projects in the handsome volume under consideration. Fittingly he dedicates the book to "John W. Powell, the far-seeing philosopher; Francis G. Newlands, the constructive statesman; and Frederick H. Newell, the faithful administrator; the pioneers who blazed the way for the beneficient work of national reclamation."

Except for a brief and interesting introduction and a short but valuable final chapter summing up the achievements of the Reclamation Service in terms of ultimate aim—"Settlement and Cultivation"— the entire book is devoted to descriptions of the various projects. The plan followed is to give the history and a general description of each project in a few sentences, and then to describe the works in their natural order, from dam and storage reservoir to water delivery to each farm unit.

Besides the descriptions of structural works, the volume contains information on a variety of special topics. In the order found in the index some of these are: Alkali, action of concrete; cement, sand; capital needed by settler; concrete pressure pipe; crop results; difficulties of settlers; disintegration of concrete; farm unit, size of; grouting foundation; percolation tests; return seepage; sand manufacture, cost of. Cost

figures are presented, generally in summarized form. Due credit is given to the leading engineers connected with the several projects. Particular acknowledgment is made to E. A. Moritz, who wrote the description of the Sunnyside project, and to Prof. F. H. Newell, formerly director of the U. S. Reclamation Service.

Besides its value as an account of governmental enterprise in the reclamation of land, the book is a welcome addition to the literature of irrigation, and of dams, canals, pipe lines, and other structures common to hydraulic works.

Essentials of Materials of Engineering

TEXTBOOK OF THE MATERIALS OF ENGINEERING: By Herbert F. Moore, Research Professor of Engineering Materials, Engineering Experiment Station, University of Illinois. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 204; illustrated; $2.

Frankly a textbook for the initial construction of the uninformed, Professor Moore's little book is remarkably comprehensive. In comparatively brief space he gives all of the essential information regarding the nature of materials used in engineering and outline; some of the problems connected with the inspection and testing of those materials. Aside from its value as an instruction text, the book should have a place as a ready reference for the practising engineer who has forgotten or mislaid some of the details of material manufacture or behavior.

The first chapters present the general principles of the strength of materials. The main part of the book is devoted to separate chapters on each of the various materials. Then follow chapters on the details of testing. A final chapter is added on a subject for which the author is especially qualified to speak, the resistance of materials to repeated stress. As an aid to the use of the book in schools there is an appendix containing lists of questions on the subject treated.

The Legal Side of Engineering

BUSINESS LAW FOR ENGINEERS—By C. Frank Allen, M. Am. Soc. C. E. Part 1. Elements of Law for Engineers. Part 2. Contract Letting. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 494; $3.

Books on the legal side of engineering are common and form part of the library of virtually every engineer. Professor Allen's new book, however, seems to fall in a somewhat different class, particularly the first half. It is divided into two parts, one entitled "The Elements of Law for Engineers" and the second called "Contract Letting." The contract section is quite similar to that in other books of this type. The first section, however, on elementary law, is very much clearer and more definitely stated than is usually the case with legal texts written for the benefit of the engineering profession. The chapters take up not only those sections of elementary law which are obviously applicable to engineering, but others of the apparently less related subjects which, however, are shown to bear upon engineering work. The chapter headings, for instance, are: "Evidence," "Contracts," "Torts," "Equity," "Real Property," "Corporations," "Agencies," "Master and Servant," "Sales," "Negotiable Instruments," "Railroads" and "The Engineer's Legal Relations With Others."

Throughout the book a remarkably simple and clear system of arrangement is used, and the value is enhanced by well-thought-out typography. Apparently every effort has been made to leave out extraneous matter such as is common in legal books, for, although Professor Allen is a lawyer, he is primarily an engineer and has considered his book as being addressed particularly to engineers.

Useful Engineering Formulas

EMPIRICAL FORMULAS—By Theodore R. Running, Associate Professor of Mathematics, University of Michigan. Mathematical Monographs No. 19. Edited by Mansfield Merriman and Robert S. Woodward. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Cloth, 6 x 9 in.; pp. 143; illustrated; $1.40.

The obtaining of a mathematical expression to represent the relations between two variables is a constant engineering necessity. It manifests itself usually in the finding of an algebraic expression for some curve plotted from physical observations. The literature on this subject has not been too full, so that Professor Running's book should prove quite useful. The subject is one which does not occur very often in an engineer's practice, but when it does he usually has to resort to some textbook to refresh his memory or to instruct him in the elements of the subject. No better book could be found than this one. Although it is of the highest mathematical elaboration, it is quite easily comprehended by anyone who has had the usual college engineering training in the subject.

Port and Harbor Bibliography

SELECTED BIBLIOGRAPHY ON PORTS AND HARBORS: Their Administration, Laws, Finance, Equipment and Engineering—Compiled by William Joshua Barney, C. E., Secretary; The American Association of Port Authorities. New York: The Secretary, 29 Broadway, New York City. Paper; 6 x 9 in.; pp. 144; $1.

The American Association of Port Authorities, through its secretary, William J. Barney, of 110 West 40th St., New York City, has published a book called "Selected Bibliography on Ports and Harbors and Their Administration, Law, Finance, Equipment and Engineering," which is a most valuable reference for engineers engaged in this kind of work. This applies to a great number of engineers today when the terminal and port situation is uppermost in many minds. The book gives references to periodicals and books under a number of headings.

Papers on Activated Sludge

Two papers on the activated-sludge process of sewage treatment, both by Edward Ardern, have been reprinted separately from the *Journal of the Society of Chemical Industry* for Jan. 31 and July 31, 1917 (Broadway Chambers, Westminster, S. W., England). These papers continue the series contributed by Ardern and Lockett to the *Journal* in its issues of May 30 and Dec. 15, 1914, and Sept. 30, 1915.

Typical Deterioration of Brasses

The submission to the U. S. Bureau of Standards, Washington, D. C., of numerous samples of deteriorated brass which have proved to be typical cases, has led to the publication of a bulletin on the typical corrosion of Muntz metal or brass of the type 60 copper 40 zinc.

This is used commercially in a wide variety of forms, such as bolts, sheathing, condenser tubes, strainers, etc., and often changes color and becomes weak and brittle. This bulletin (Technologic Paper 103) shows that the change is due to a selective corrosion of the alloy when exposed to liquids like sea-water. The zinc constituent is leached out, leaving a weak skeleton of copper which may be attacked and reduced to pulverulent form. It is reported that this corrosion is accelerated by certain microstructures, by contact with electro-negative metals, by adhering products of the corrosion, by the annealing and by stresses during corrosion.

Catskill Aqueduct Souvenir

The latest number of the *Journal* of the Municipal Engineers of the City of New York is a souvenir edition, devoted exclusively to the Catskill Aqueduct, the completion of which was celebrated Oct. 12, 13 and 14. Editor Percy C. Barney, chairman of the society's publication and library committee, has presented a history of the Catskill work, with photographs and drawings, and has included biographical sketches of many of the men on the engineering bureau of the New York Board of Water Supply. There is also a tabulated statement of the Catskill aqueduct contracts, giving name of contractor, kind of work and cost as indicated by the final estimate. The price of this number of the *Journal* is 50 cents and copies are obtainable from George A. Taber, secretary, 13 Park Row, New York City.

Sewer Drop Manholes

Six types of sewer drop manholes are described and illustrated in 16 pages of the *Journal* of The Municipal Engineers of New York (Engineering Societies Building, New York City) for September. The article is by Irwin W. Whittemore, assistant engineer, Public Service Commission, First District. The paper is based on studies made in connection with the construction of the New York subways, which necessitated lowering many sewers.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor, the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.]

THE J. E. ALDRED LECTURES ON ENGINEERING PRACTICE: 1916-1917. The Johns Hopkins University, Baltimore, Department of Engineering. Baltimore, Maryland: The University. Paper; 6 x 9 in.; pp. 253; illustrated; $1.

Nine different men, mostly engineers, in the three fields of civil, electrical and mechanical engineering, delivered these lectures to undergraduate students in March and April, 1917. The lectures were made possible by J. E. Aldred and the same general plan will be followed yearly hereafter. The lectures are designed to be practical and are open to the general public.

THE CITY MANAGER PLAN FOR CHICAGO: Draft of a bill for the reorganization of the municipal government, with explanatory statement. Prepared and presented for public consideration by the Chicago Bureau of Public Efficiency, 315 Plymouth Court. Chicago, Ill.: The Bureau. Paper; 6 x 9 in.; pp. 60.

COMMISSION OF CONSERVATION, CANADA: Report of the Eighth Annual Meeting held at Ottawa, Jan. 16-17, 1917. Ottawa: The Commission. Cloth; 7 x 10 in.; pp. 344; illustrated.

DAILY RIVER STAGES AT RIVER GAGE STATIONS ON THE PRINCIPAL RIVERS OF THE UNITED STATES: Volume XIV, for the year 1916—By Alfred J. Henry, Professor of Meteorology. Washington, D. C.: U. S. Department of Agriculture. Paper; 9 x 11 in.; pp. 278.

DETERIORATION IN THE HEATING VALUE OF COAL DURING STORAGE—By Horace C. Porter and F. K. Ovitz. Washington, D. C., Bureau of Mines. Paper; 6 x 9 in.; pp. 38; illustrated.

A DIGEST OF THE DECISIONS OF THE RAILROAD COMMISSION OF WISCONSIN: Covering the Decisions Published in Volumes I to XV, inclusive, of the Commission's Official Reports, July 20, 1905, to Feb. 4, 1915. Compiled by Harold L. Geisse, Secretary. Madison, Wisconsin: The Secretary. Cloth; 6 x 9 in.; pp. 805.

EFFECTS OF STORAGE UPON THE PROPERTIES OF COAL: By S. W. Parr, Professor of Applied Chemistry, Urbana, Illinois Engineering Experiment Station. Paper; 6 x 9 in.; pp. 44; illustrated.

EVAPORATION FROM THE SURFACES OF WATER AND RIVER-BED MATERIALS: By R. B. Sleight, Assistant Irrigation Engineer, Office of Public Roads and Rural Engineering, United States Department of Agriculture. Washington, D. C.: The Department. Paper; 7 x 10 in.; pp. 273; illustrated.

FINANCIAL STATISTICS OF CITIES HAVING A POPULATION OF OVER 30,000: 1916; Department of Commerce, Bureau of The Census. Sam. L. Rogers, Director, Washington, D. C., Superintendent of Documents, Government Printing Office. Paper; 9 x 12 in.; pp. 375; illustrated; $1.

GLOSSARY OF AVIATION TERMS—TERMES D'AVIATION: Compiled by Lieutenants Victor W. Page, A. S., S. C., U. S. R., and Paul Montariol of the French Flying Corps, on duty at Signal Corps Aviation School, Mineola, L. I. New York: The Norman W. Henley Publishing Co. Cloth; 5 x 8 in.; pp. 94; illustrated; $1.

HYDRAULIC CONVERSION TABLES AND CONVENIENT EQUIVALENTS: Water-Supply Paper 425-C. U. S. Geological Survey. Department of the Interior, Franklin K. Lane, Secretary. Washington, D. C.: The Secretary. Paper; 6 x 9 in.; pp. 94.

Most of the tables in this handy collection are designed for use in converting discharge per second-feet per square mile into various equivalents used in water-works, irrigation, water-power practice and storm-water drainage practice. There are also some length, surface, volume, hydraulic and miscellaneous tables and some map scales.

LOCOMOTIVE HAND-BOOK: Compiled by American Locomotive Co., 30 Church St., New York City. New York: The Company. Leather; 4 x 6 in.; pp. 195; illustrated; 75 cents.

This is a carefully compiled little book. Most of the information is of course for the mechanical rather than the civil engineer. There are, however, considerable data on tractive efforts and train resistance, about which few of us know too much, and there are also tables and diagrams at least interesting to anybody interested in that remarkable machine—the modern locomotive.

OHIO TOPOGRAPHIC SURVEY: Final Report, Vol. II, 1917. Surveying Marks and Monuments—By C. E. Sherman, C. E. Columbus, Ohio: The Survey. Cloth; 6 x 9 in.; pp. 760; $1.

THE PRODUCTION OF IRON AND STEEL IN CANADA: During the calendar year 1916. John McLeish, B. A., Chief of the Division of Mineral Resources and Statistics. Ottawa, Ontario, Canada: Department of Mines. Paper; 6 x 9 in.; pp. 50.

RAILROAD COMMISSION, STATE OF WISCONSIN: Opinions and Decisions—Nov. 15, 1915, to May 29, 1916. Compiled by Harold L. Geisse, Secretary. Madison, Wisconsin: The Secretary. Cloth; 6 x 9 in.; pp. 1147.

RAND WATER BOARD: Report for 1916-17. W. Ingham, Chief Engineer, Johannesburg, Union of South Africa. Paper; 8 x 13 in.; pp. 57; illustrated.

SCIENTIFIC PAPERS OF THE BUREAU OF STANDARDS: An Aneroid Calorimeter for Specific and Latent Heats—By Nathan S. Osborne, Associate Physicist; Washington, D. C. Superintendent of Documents, Government Printing Office. Paper; 7 x 10 in.; pp. 26; illustrated; 10 cents.

SHAPE BOOK: Containing Profiles, Tables, and Data Appertaining to the Shapes, Plates, Bars, Rails, and Track Accessories. Pittsburgh, Penn.: Carnegie Steel Company. Leather; 5 x 8 in.; pp. 351; illustrated; $1.

THE SUBSTITUTION OF OTHER MATERIALS FOR WOOD: Studies of the Lumber Industry. Part XI—By Rolf Thelen, Engineer in Forest Products. Washington, D. C. Superintendent of Documents. Paper; 6 x 9 in.; pp. 78; illustrated; 15 cents.

A historical study of the replacement of wood by other structural materials, together with a statistical résumé of the amount of wood so replaced and a description of the uses to which the substitute materials are put.

TECHNOLOGIC PAPERS OF THE BUREAU OF STANDARDS: Some Unusual Features in the Microstructure of Wrought Iron—By Henry S. Rawdon, Associate Physicist; Washington, D. C. Superintendent of Documents, Government Printing Office. Paper; 7 x 10 in.; pp. 25; illustrated; 5 cents.

TRANSACTIONS OF THE AMERICAN CERAMIC SOCIETY—Volume XIX: Containing the Papers Read at the Meeting Held at New York, N. Y., Mar. 5, 6, 7 and 8, 1917, together with Supplementary Discussions and Other Matters. Arthur S. Watts, Editor. The Secretary, Edward Orton, Jr., Columbus, Ohio. Cloth; 6 x 9 in.; pp. 707; illustrated.

TRANSACTIONS OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS: January to June, 1917. Montreal: The Canadian Engineer. Paper; 6 x 9 in.; pp. 352; illustrated.

HINTS FOR THE CONTRACTOR

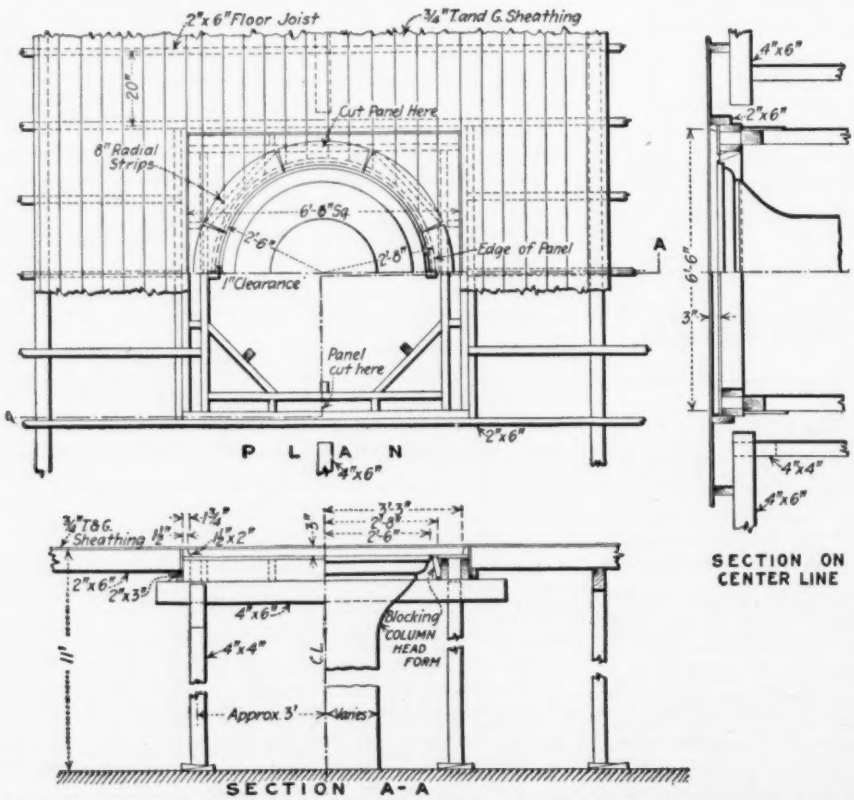
DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Floor Panel Form Permits Removal of Column Forms

FLOOR-SLAB FORMS for the depressed or thickened panels over the column heads have been so made on recent work as to facilitate rapid erection of the form work and also permit removal of the metal forms of the columns without disturbing the floor form. This design, shown in the drawing, was used by Stone & Webster, of Boston, for concrete buildings at Pittsburgh. J. F. Love was the company's superintendent on this work.

The panel form is made 1 in. larger on each side than the metal column-head form which fits into it, and supports this latter by wood blocks nailed in place, as shown. By knocking off these blocks, the metal form is left entirely free. This construction increases the accuracy of setting the column forms. When the wood work is erected and securely braced, the center lines for the column are marked in both directions, and the column-head form is then set by these marks. The narrow opening between the panel and head forms is covered by segmental strips of metal nailed in place.

The panel form is built in halves, which are assembled for erection by nailing a 2 x 6-in. strip along each jointed side. These strips are long enough to rest on the regular floor stringers which are erected on either side of the column before the panel form is placed. As they are the same depth as the joists they do not interfere with the rest of the form work for the floor. The depressed-panel form is supported by separate bents.



FORM FOR DEPRESSED FLOOR PANEL PERMITS EASY REMOVAL OF COLUMN FORM

Fence Posts Driven Speedily By Small Piledriver

IN RUSHING through to early completion the 17-mile board fence at the cantonment at American Lake, Washington, it was found that a small piledriver made it possible to reduce greatly the time required for putting down the posts. About 11,000 posts had to be placed on 8-ft. centers. The posts varied from 5 to 10 in. in diameter and were 9 ft. long, of which 3 ft. was below ground.

The piledrivers, three of which were built, were provided with 4-hp. Fairbanks-Morse gasoline engines operating a small drum by means of a friction clutch. The hammer, of cast iron, weighed 600 lb. and was arranged for a 6-ft. drop when beginning on a 9-ft. post. The entire equipment was mounted on a two-horse truck, the leads projecting over the rear end. The points at which posts were to be driven were marked by pegs and the team was driven down this line of pegs, stopping every 8 ft. to drive a post.

The frame on which the piledriver proper was mounted was attached to the truck by a pin at the forward end, thus permitting the rear end of the frame, and the leads which it carried, to be swung from right to left as desired. By this arrangement it was only necessary to stop the team at the proper distance each time; the swinging leads being depended upon to correct any small error in alignment.

With this equipment a crew of four, consisting of teamster, engine driver and two post rustlers, could drive 180 posts in 8 hours. The actual time of driving per post varied from 1 to 1½ min. The posts were pointed and delivered along the fence line ahead of the driving rig.

As is often the case on construction of an unusual nature, the plan was not a notable success as tried out

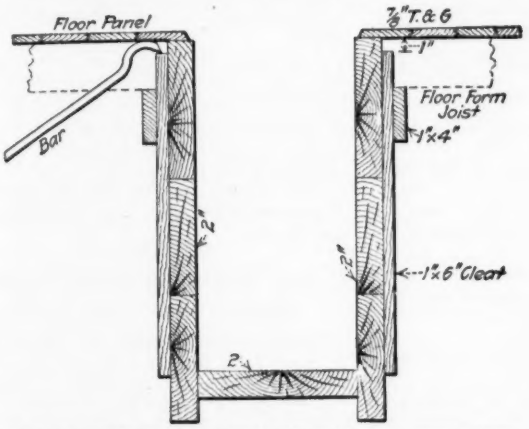
with the first crew, but when a foreman was put in charge who believed that the scheme was a good one, trouble and delays resulting from breakdowns were greatly reduced and the good rate of progress mentioned was attained.

The work was done under the direction of the Hurley-Mason Co., who held the general contract for the cantonment construction, description of which appeared in *Engineering News-Record* of Oct. 4, p. 650.

Cleats on Side of Beam Form Give Good Purchase for Stripping

By Samuel Warren
New York City

IF THE FOLLOWING method is used in making beam and girder forms, it will be easy to loosen them from stripping: Make the side sleats of full 1-in. material, coming up within 1 in. of the top of the side. This will give a perfect purchase for a gooseneck bar, as shown in the sketch, and will prevent injury to the form resulting from the workman trying to get a purchase by digging the end of the bar into the beam side. With the good purchase thus afforded one man can usually loosen the form, and if a man works on each side of the beam form it is sure to come down easily.



CLEATS GIVE PURCHASE FOR BARS IN STRIPPING

Strip for Car Tracks Through Pavements Removed by Machines

BY UTILIZING machines for all operations of cutting through a new asphalt pavement, breaking up the concrete base and loading the material into cars, little labor was required in preparing the roadbed for a street-car track to the new Curtiss aëroplane plant in Buffalo, N. Y. A self-propelling cutting machine of pile-driver type has a 500-lb. weight, which is fitted with a knife in the bottom and has a fall of 3½ ft. This machine with two operators cut 4000 lin.ft. of 3-in. asphalt paving in ten hours. A 15-ft. spiked roller scarified the strip and a Keystone excavator tore up the asphalt and loaded it onto cars. The cutting machine was used also to punch 1-in. holes in the 6-in. concrete base along the edge of the cut, a hole being punched with three blows. The holes were spaced 10 in. apart and 600 lin.ft. was a day's work. The row of holes forms a line on which the concrete broke when struck with a 1-ton pile hammer operated by a steam shovel. A second excavator followed the hammer, removing the broken concrete and earth to grade, and loading the material into wagons or cars. In normal operation the pile hammer broke a strip 10 ft. wide and 300 ft. long in a day. About 1½ ft. was broken off each time the shovel moved.

This work was carried out under the direction of A. P. Illig for the contractor, the German Rock Asphalt Co., Buffalo. F. V. E. Bardol, a member of this firm, devised the cutting machine for use in making repairs on asphalt paving.

Blow Out Supply Line with Steam from Mixer to Prevent Freezing

By Harlan H. Edwards
Danville, Ill.

ON SEMI-MONOLITHIC brick road work being carried out under contract by J. C. Poll, 6 miles east of Danville, Ill., steam from the mixer boiler or road roller is used to blow out the water from the 2-in. supply line along the road in freezing weather. When laid, this pipe was fitted with a 1-in. T every 200 ft. to which a hose could be attached for supplying water to the mixer. When there is any danger of water freezing and bursting the pipe during the night, Superintendent Carl Nelson attaches an old hose to the T nearest to the mixer or road roller, opens successively the other Ts along the pipe line, and blows out all the water, leaving the line empty over night.

City-Manager Plan Proposed for Chicago

Adoption of the city-manager system of municipal government for Chicago, and consolidation of the various local governments in the metropolitan district, are important steps recommended by the Chicago Bureau of Public Efficiency. Modification of the state constitution is a necessary preliminary to the unified government, but the state legislature has already authorized a vote in November, 1918, upon the proposal to call a convention to revise the constitution. In the meantime, application of the city-manager system of government is possible through legislative action, with the approval of the people in a referendum vote. This could be arranged to take effect in 1919, when the term of the present mayor expires.

The bureau has drafted a bill providing for reorganization of the city government on this basis, leaving the consolidation or unification of the various local governments until the necessary constitutional amendments are passed. The proposed law would not create the office of city-manager, but the mayor would in effect hold such a position, as he would be elected by the city council and be subject to its control.

The bill provides for one alderman, instead of two, for each of the 35 wards, with a four-year term and subject to popular recall. All the aldermen would be elected at one time, while under the present system a certain proportion are elected each year. The mayor, city clerk and controller would be chosen by the council. Heads of departments would be appointed by the mayor, and would not need to be residents of the city at the time of their appointment. The three officials and the heads of departments would have no fixed terms of office.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Defense Council Names Highways Committee

L. W. Page and H. G. Shirley Members of Advisory Body in Charge of Construction and Traffic

The appointment of the Highways Transport Committee of the Council of National Defense was announced by Director W. S. Gifford last week. The purpose of the committee is to assist the railroads and other means of transportation in the movement of supplies during the war and to work with the highway authorities to maintain the public roads in shape for such use. The membership of the committee will be:

Chairman, Roy D. Chapin, president, Hudson Motor Car Co.; Logan Waller Page, director of the Office of Public Roads, Department of Agriculture; Henry G. Shirley, chief engineer, Maryland State Roads Commission; George H. Pride, president, Heavy Haulage Co., of New York City.

The membership of the committee, according to a statement by Director Gifford, insures a broad knowledge of all problems pertaining to the construction of highways and the traffic over them. Coöperative work will be at once started with the various departments of the Government interested in the utilization of the roads of the United States for military purposes.

This will complete the list of transportation committees under the Council of National Defense and will give all forms of transportation proper representation in the war activities.

The committee, according to statements made by Mr. Chapin, the chairman, to the Washington representative of *Engineering News-Record*, is not yet complete. It is announced that the members of the committee will gather in Washington the end of this week for an organization meeting, and that its headquarters will probably be in the Munsey Building.

"After our meeting," Mr. Chapin said to the *Engineering News-Record* representative, "we will see what type of work develops, and additions to the committee will be made, selecting men who know the sort of work to be done.

"Naturally we have no policy yet. In the first place, we must make a very careful study of transportation problems around terminals, to avoid terminal congestion this winter. In the second place, we must try to coördinate all the Government department road work that may be necessary from the standpoint of military necessity."

Mr. Chapin stated that after the committee makes a study of these two points it will form a definite publicity policy.

"It is very evident, no matter what we do or what we study," he added, "that there must be close coöperation among all the transportation interests during the period of the war."

For thirteen years Mr. Chapin has represented the automobile industry in the good roads movement in this country. He is a vice president of the Lincoln Highway Association, and he said that he had been at work for six months trying to bring about the formation of such an agency as the Highways Transport Committee.

There is already talk in Washington that Mr. Chapin, by reason of the chairmanship he now assumes, may be made an ex-officio member of the War Board of the American Electric Highway Association, recently formed, which is to take the place of the committee of that association working with the Council of National Defense. When Mr. Gifford made the announcement of the creation of the Highways Transport Committee, it was said informally that the highways committee would bring about the greater use of highways and inland waterways for short hauls. As the electric railways are also vitally interested in terminal congestion and short hauls, and as the electric railway war board has appointed Daniel Willard, head of the steam transportation interests, as an ex-officio member, it is felt in Washington, in some quarters, that close coöperation between the Highways Transport Committee and the Electric Railway War Board would be a wise thing, in view of the fact that coördination of all transportation interests is desired.

City Managers Will Meet in Detroit

The City Managers' Association will hold its fourth annual convention at the Hotel Statler, Detroit, Nov. 19 to 22. Some of the sessions will be held in connection with the National Municipal League, which will have its annual convention at the same place beginning Nov. 21. Actual experiences of city managers will fill in a large part of the program of their meeting. In addition, there will be a few addresses on pertinent municipal subjects by men not connected with the association, a departure from previous conventions. O. E. Carr, city manager of Niagara Falls and president of the City Managers' Association, states that of the 83 city managers listed in the 1916 "Proceedings" of the association, 30 were known to be engineers and 13 were known not to be engineers, while no information was available regarding the previous professions of the other managers in the list.

Shipping Board Provides for Housing of Workers

Better Accommodations and Transportation Facilities Needed for Men Who Will Build Fleets

The United States Shipping Board took further steps to speed up the shipbuilding program and get a small army of new employees to fill the gaps in the big shipyards.

Better housing and transportation facilities are to be provided for the workmen, as complaints have been received from some of the shipyard districts that it would be difficult to provide the proper accommodations for enough men to put on double and triple shifts.

J. Rogers Flannery, of Pittsburgh, has been drafted from the ranks of the Red Cross by Chairman Hurley, of the Shipping Board, to take charge of this work, and submitted his first report on conditions in Baltimore, so that additional men who are badly needed at the Sparrows Point yards can be provided for at once.

U-Boat Again Successfully Trucked Through New York Streets

Having aided in arousing enthusiasm in New York for the Liberty Loan, the captured German U-Boat C 5, renamed the "U Buy a Bond," has been taken to Canada to aid in the raising of the Victory Loan there. The submarine was taken from Central Park to the West 130th Street Pier on a 100-ton steel Reach truck drawn by four motor trucks, two Macks of 5½ and 7½ tons, and two Packards of 6½ tons each. The three heavy sections of the boat were transported through the New York streets on Nov. 7, 8 and 9, by the Howes Transportation and Contracting Co., without damage to the city streets. As stated in *Engineering News-Record* of Nov. 1, p. 828, the three sections of the submarine formed perhaps the heaviest loads ever carried on four wheels through city streets in this country.

Stinchcomb Beaten for Mayor

Cleveland citizens, it seems, are not sufficiently appreciative of the blessings that would flow from having an engineer in the mayor's chair, for the voters "turned down" William A. Stinchcomb, Democratic candidate, on Nov. 6. Mr. Stinchcomb is a civil engineer and county surveyor of Cuyahoga County, in which Cleveland is situated. Some details of his biography were given in *Engineering News-Record* of July 19, p. 143.

General Biddle Now Assistant Chief of Army Staff

Major General John Biddle, who returned from France on Oct. 28, has been appointed assistant chief of staff, U. S. A. General Biddle was formerly president of the Army War College, and is one of the best known engineer officers in the Army. Appointed from Michigan to the Military Academy in 1877, he was graduated with the class of 1881, ranking second and being appointed second lieutenant of engineers. During the Spanish-American War he held the rank of lieutenant colonel as chief engineer, United States Volunteers. At various times General Biddle has had charge of river and harbor work at Nashville, Tenn., at San Francisco, at Savannah, and at Baltimore. From December, 1914, until June, 1915, he was military observer for the United States Army with the Austro-Hungarian army in Austria and Poland. In 1916 General Biddle returned to the Military Academy as superintendent and served approximately a year in that capacity.

Contract for 18-Mile Shandaken Tunnel Awarded to Degnon

The contract for the 18-mile Shandaken tunnel of the Catskill aqueduct, for which bids were received Sept. 11 (see *Engineering News-Record* of Sept. 13, p. 523), was awarded by the Board of Water-Supply of the City of New York on Nov. 9 to the Degnon Contracting Co., the low bidder, the total cost, based on the estimated quantities and the unit prices, being $12,138,000. The incoming Tammany administration, which, however, does not assume office until Jan. 1, has requested that the work be held up. Mayor-elect John F. Hylan and his associates on the Municipal ticket, Charles L. Craig and Alfred E. Smith, have sent the following letter to the Board of Water-Supply:

"Gentlemen: On Nov. 9 your board executed a contract with the Degnon Contracting Co. for the construction of the Shandaken Tunnel, connecting the Schoharie watershed with the Catskill Aqueduct. The contract price was $12,138,738. The contract contains a provision that the contractor shall begin work ten days after the serving of a notice by your board instructing him to begin work. The contract also contains a provision by which the board reserves the right to suspend the whole or any part of the work without compensation to the contractor for such suspension. The period within which the contract must be completed after the giving of the notice is seven years.

"This contract was awarded upon the assumption that the city will need the new water supply by the time the work is completed, and its conclusion is based upon the further assumption that the per capita consumption of New York City is 110 gallons of water per day, and that the increase in population will be at the uniform rate of 157,227 per annum.

"In view of the conditions resulting from the prosecution of the war and their effect upon the price of labor and material and the derangement of industry generally, and the serious strain upon the finances of the whole country by the expenditures required for the war, it seems to us that unless there is some overwhelming necessity that requires the prosecution of this construction work on the Shandaken Tunnel at the present time, that it should not now proceed.

"In order to give the incoming Board of Estimate and Apportionment an opportunity to look into the matter and make such recommendations or take such actions as a full investigation require, we hereby request that your board refrain from serving the notice upon the contractor provided for by Article VI of the contract, and that your board exercise the right to suspend the whole of the work under the contract pursuant to provision VII of the contract for at least ninety days, so that the new Board of Estimate may be properly advised and discharge whatever responsibilities it may have to the City of New York.

Very truly yours,
JOHN F. HYLAN,
CHARLES L. CRAIG,
ALFRED E. SMITH."

1500 Road Builders Have Joined 23rd Engineers

Already More Than 8000 Applications for Enlistment Have Been Received—Prize Drill Held

COMMANDING OFFICER AND STAFF OF THE 23RD ENGINEERS, THE NEW ROAD-BUILDING REGIMENT

Sitting, left to right: Maj. F. S. Skinner, Maj. I. C. Moller, Col. E. N. Johnston, Maj. C. B. Wing, Maj. H. H. Stickney, Jr. Standing, left to right: Capt. W. H. Messinger, Capt. R. G. McGlone, Capt. F. H. Ellis, Capt. W. M. Torrance

Men from the far West and the far South have begun to arrive at Camp Meade, Md., to join the 23rd United States Engineers, composed of road builders and other highway construction men. In groups of from 75 to 100 a day, they are coming from all over the country, and are being rapidly whipped into shape. More than 8000 applications to join the regiment have been received, although not all applicants were acceptable and many could not pass the physical examinations. As it stands, however, there are now 1500 men at Camp Meade in the regiment.

These men, according to the Washington representative of *Engineering News-Record*, quoting high army officers, are making a fine showing. Last Sunday a competitive drill between the companies of the regiment was held. It began with a review by Major General Biddle, acting chief of staff of the army; Major General Kuhn, commanding the 79th Division at Camp Meade; Brigadier General Abbott and Brigadier General Winslow, as well as Colonel Johnston, commanding the 23rd, and his staff officers. The first prize in the drill, $200 in cash, was won by Company C; the second prize, $50 in cash, was won by Company D; and the third prize, $25 in cash, was won by Company A. These drills for cash prizes are a feature of the training of this organization, and they have had a stimulating effect on the work of the men.

The regiment is now organizing a full brass band, and is still in want of men who can play the fife as well as build roads. In fact, the regiment is still in need of several thousand axemen, blacksmiths, boatbuilders, carpenters, caterers and cooks, car repairers, stone-crushing plant operators, drill runners, grading men, mechanical engineers, quarrymen, riggers, roller men, shoemakers, tailors, tire repair men, both rubber and metal, and general utility mechanics.

Men of the very highest type are joining the regiment, and Colonel Johnston, 1419 F St., N. W., Washington, D. C., to whom all applications should be addressed, received a few days ago a letter from a Spaniard who served under the Spanish colors during the Spanish-American War, who now wants to join the regiment and fight under the American colors against the Germans by helping to build and rebuild roads in France.

A gala occasion is being planned for the regiment at Camp Meade. During the latter part of this month, at a date yet to be selected, there is to be a spectacular presentation of colors to the regiment by its friends.

Big Passaic Valley Sewer Will Be Delayed

Cannot Be Completed Next Year as Originally Planned—Cost Now Placed at $15,000,000

Completion of the Passaic Valley, N. J., sewer is not now expected before the spring of 1919, despite the plans and hope of the Sewer Commission to have it ready by Dec. 31, 1918, the time set for finishing the work.

This was stated by Adrian Riker, counsel for the commission, in an official announcement covering the history of the construction, made before representatives of all interested municipalities. In a paper read by Mr. Riker the delays were explained, unexpected obstacles encountered in prosecuting the work were enumerated and detailed data on the cost presented, showing why expenditures had climbed high above the original estimate of $11,500,000, and is now placed at $15,000,000.

However, Mr. Riker explained, the amount to be paid by additional municipalities coming into the league will so reduce pro rata assessments on the fifteen original municipalities in the contract that the cost of these fifteen will not exceed $12,000,000, and may fall to the $11,500,000 originally stated. The health menace in the pollution of the Passaic River was dwelt upon by Mr. Riker in reviewing conditions that forced action for the completion of the big sewer.

Bonds for $2,800,000 Sewers Voted in Toledo

A $2,800,000 sewer bond issue was authorized by a vote of almost two to one at the election in Toledo, Ohio, Nov. 6. H. C. McClure, commissioner of engineering and construction, states that it is planned to enact bond ordinances soon for some $700,000 worth of the proposed improvements, including the Ten Mile Creek interceptor and the Bay View Park pumping plant. This includes six miles of 48- to 72-in. sewers and two siphons. About half of the sewer work will be in open cut and about half in tunnel, the latter being 72-in. sewers. It is expected that bids will be wanted about Feb. 1, 1918.

Chicagoans Vote $1,000,000 for County Roads

That voters recognize the necessity for good roads in war times was emphasized on Nov. 6 in Cook County, Illinois, by the authorization of $1,000,000 bonds to construct 48 miles of hard pavement which will complete five different through routes. Three other bond issues were defeated by large majorities. The decision for roads was made a week previous in Lake County, to the north of Cook, when $500,000 was authorized. The favorable vote of both counties was necessary to obtain state and Federal aid for the Chicago-Milwaukee road.

American Society Moves Quietly to Its New Home

With characteristic absence of fireworks the American Society of Civil Engineers held its first meeting last week in its new home, the Engineering Societies Building, 29 West 39th St., New York. It was the regular semi-monthly meeting of Nov. 7, and the meeting conformed closely to the pattern adopted many years ago for these meetings. One concession was made to the importance and solemnity of the occasion, in that the main auditorium, instead of one of the smaller rooms, was selected for the synoptical reading of the papers; but the attendance indicated that one of the smaller rooms would have been ample.

In explanation of the absence of any special program to commemorate the consummation of the most important step ever taken by the society, it was explained that the Board of Direction had concluded that a technical meeting was not the place for a celebration, and that the celebration would take place at a special meeting Dec. 7. Details of this meeting will be announced later.

Civilian Engineers Put in Charge of Shipbuilding

A readjustment of the organization of the Emergency Fleet Corporation went into effect on Nov. 12 by which several well-known civilian engineers were given supervision of certain details of the Federal shipbuilding construction program. Charles Piez, president of the Link-Belt Co., of Chicago, has been appointed a vice president of the corporation, in charge of the actual construction of the new vessels. James Heyworth, a Chicago contractor, has been placed in control of the wooden ship construction, and Charles Day, of the firm of Day & Zimmerman, of Philadelphia, has gone to London to study the fabricated ship work in England and to apply the experience there to our problems. A. J. Meson, another Chicago engineer, has been detailed to field supervision of the various yards under the corporation's direction. A naval architect, Frank Kirby, of New York, has also joined the personnel.

Atterbury Directs Transportation System in France

Maj. Gen. W. W. Atterbury, formerly operating head of the Pennsylvania R.R. lines, has been appointed head of the transportation department of the American forces in France. He was selected for the post by General Pershing. The new arrangement means that hereafter the Quartermaster Corps will be only a distributing factor in the general supply scheme. The transportation department will handle all transportation of troops and material from vessel to rail heads. It will, likewise, have charge of construction work for transportation, thus relieving the American army engineers of much work.

San Francisco To Have Largest Shipbuilding Plant

The Risdon Iron Works, adjoining the Union Iron Works plant on San Francisco Bay, have been commandeered by the Government and will be operated under Union Iron Works' management in carrying out additional Government contracts. The Risdon yards include 30 acres of ground with eight shipbuilding slips. The decision to take them over for Government work was reached in Washington on Oct. 13.

The Risdon Iron Works have been owned by the United States Steel Corporation since 1911, when they were taken over as a supply and shipping point for the United States Steel Products Co. Changes to be made at once contemplate putting the eight slips in shape for immediate use and the addition of machine shops and other attendant equipment. With this addition the Union Iron Works are said to be the largest shipbuilding plant in the United States.

Simultaneous announcement was made in the daily press of the decision at Washington to create a naval base for the Pacific Coast on San Francisco Bay at Hunters Point. It is stated that at this base at least two dry docks will be provided, capable of handling the largest ships the Panama Canal can accommodate, and that other construction would be undertaken, bringing the total expenditure at the site up to about $25,000,000.

Voters of Cincinnati Approve Charter; Bond Issue Loses

The home rule charter framed by a special committee for the City of Cincinnati was adopted by a popular vote of almost 2 to 1 at the election held Nov. 6. The vote in favor of adoption was 57,791; opposed, 26,301. In *Engineering News-Record* of Oct. 11, p. 716, the principal provisions of the new charter were printed.

At the election the $500,000 bond issue for continuing the construction of intercepting sewers in Cincinnati lost by failure to receive the required majority vote, the vote in favor of the bond issue being 42,255, and against the issue, 26,766. The failure of this issue of bonds to meet with approval will result in a modification of the sewer work planned for 1918 by the city engineer, Frank S. Krug.

Government Takes All Pine Timber for Ships

The Government this week sent out to 500 long-leaf pine mills notice of an embargo on all timbers over 2 in. thick and 10 in. wide, any length. All timbers over these dimensions must be reserved for shipbuilding, unless it is shown that they are needed for other purposes of paramount importance, when the embargo will be released, on application.

$3,000,000 Sewer Bonds Approved in Cleveland, Ohio

Cleveland voters approved by a narrow margin bonds in the sum of $3,000,000 for sewer construction and repair. Cleveland also approved the initiative ordinance enabling the mayor to appoint a rapid transit commission, and voted more than two to one in favor of an eight-hour day for city employees in classified service. By registering their approval of the initiative ordinance, authorizing the mayor to appoint a rapid transit commission, the voters signified their approval of plans for building of a terminal subway.

ENGINEERING SOCIETIES

Calendar

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 West 39th St., New York; Jan. 16 and 17, 1918, New York; Charles Warren Hunt, secretary.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York; Dec. 4-7, New York; Calvin W. Rice, secretary.

GENERAL CONTRACTORS' ASSOCIATION; 51 Chambers St., New York; Dec. 8, New York; C. A. Crane, secretary.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, 35 Nassau St., New York; Jan. 14, New York; F. A. Molitor, secretary.

NEW ENGLAND WATER-WORKS ASSOCIATION; 715 Tremont Temple, Boston; Jan. 9, Boston; Willard Kent, secretary.

AMERICAN WOOD PRESERVERS' ASSOCIATION; Baltimore, Md.; Jan. 22-24, Chicago; F. I. Angier, Baltimore & Ohio R.R., Mount Royal Station, Baltimore, Md., secretary.

CANADIAN SOCIETY OF CIVIL ENGINEERS; Montreal; Jan. 8, Montreal; Fraser S. Keith, 176 Mansfield St., Montreal, Can., secretary.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS; Dec. 27-29, Chicago; C. K. Shedd, Ames, Ia., secretary.

The Associated Engineering Societies of St. Louis held a meeting Oct. 31. Clinton H. Fisk, chief engineer of construction of city streets, sewers and bridges, read a paper on "The Construction, Maintenance and Benefits of Concrete Roadways." The meeting was held under the auspices of the St. Louis Association of Members of the American Society of Civil Engineers.

The Engineers' Sub-Division, Chicago Association of Commerce, has a committee headed by C. W. Morse, chief engineer, Chicago, Rock Island & Pacific Railway Co., which is making a canvass of drafted skilled artisans and technical men with the idea of assisting them to get into lines similar to their own in Government service.

Cincinnati Engineers' Club is starting the season with much enthusiasm. The unusually large attendance of 100 to 150 appears to be due in part to the lunch feature and in part to the fact that any other opportunity for Cincinnati engineers to get together is exceedingly limited. Plans for the season's program indicate that a major number of the speakers will be from outside of the city. Last year two-thirds of the schedule was made up of local talent.

The Engineers' Club of Columbus, Ohio, is the first organization in the city to recruit its company of reserves to full strength. The company is drilled every Monday evening by Capt. E. A. Silagi. Recent meetings included a paper by C. B. Hoover on "The Sewage-Disposal Problem at Columbus," and one by J. J. Morgan on "The Design and Construction of the New Imhoff Tanks."

The Seattle Branch of the American Society of Civil Engineers recently entertained Maj. Gen. H. A. Greene, commanding at American Lake cantonment, Camp Lewis, Washington, at a luncheon at the Frye Hotel. Major General Greene spoke briefly on the duties and training of the soldier-engineer and of the great service that will be rendered by army engineers in the present war.

The Pittsburgh and Cleveland District Sections of the Association of Iron and Steel Electrical Engineers will hold a joint meeting at the Hotel Courtlandt, Canton, Ohio, Nov. 24. Papers on "Central Station Power," by W. A. Hornlein, and "Electrical Furnaces," by J. D. Donovan, will be presented. At the next meeting of the Philadelphia section, Dec. 1, O. H. Eschholz, Pittsburgh, Penn., will read a paper on "Some Recent Investigations in Arc Welding."

The Southwestern Society of Engineers held a convention in El Paso, Tex., Oct. 18-20, inclusive. At the afternoon session of the 18th, Prof. A. F. Barnes, dean of the engineering school, New Mexico Agricultural and Mechanical College, made an address on "The Engineering School in the War" which was followed by a business meeting and the nomination of officers, which were as follows: For president, Dean G. M. Butler, University of Arizona; first vice president, Dean S. H. Worrell, Texas State School of Mines; secretary, C. E. Barglebaugh; treasurer, R. W. Goddard; for directors, W. E. Robertson and Gerald Sherman. At the evening session, Dr. Ira N. Hollis, president of the American Society of Mechanical Engineers and of the Worcester Polytechnic Institute, spoke on "The Engineer in the Present War." At the morning session of the 19th, there was a demonstration of pontoon bridge building by the Ninth Engineers at Camp Cody and at the afternoon session an address by C. A. Tilton on "The Problems in Army Cantonment Construction" and by Dean G. M. Butler on "Some Effects of the Draft Law on Arizona Industry." The evening session was devoted to a banquet at which Dean F. H. Worrell served as toastmaster. On the 20th, there was a demonstration of trench and fortification buildings by the Eighth Engineers. Announcement was made that practically 20% of the membership of the society is now in war service, and that the spring convention will be held in Arizona and will consist of traveling meetings at the principal mining camps.

The Western Society of Engineers was addressed Nov. 5 by O. P. M. Goss, consulting engineer, Seattle, Wash., on "Lumber and Lumbering." The first meeting of the newly formed mechanical section will be held Nov. 26, at which C. W. Bradley will talk on "Manufacture and Distribution of Gas." Satisfactory progress is being made toward coöperation with the local section of the American Society of Mechanical Engineers, which usually holds four meetings a year at different hotels, a dinner preceding the program.

Philadelphia Engineers' Club conducted a campaign last summer to raise $75,000 for its new quarters, adjoining the present ones. Not to any apathy of members but on account of the unpropitious time and heavy demands in other directions, about $35,000 only was subscribed. There is a well-defined sentiment to turn the club's activities into a social direction and let the Franklin Institute take care of all technical work.

Engineering Society of Western Pennsylvania has just issued its annual year book. Following the example of the Western Society of Engineers, the efficient method of listing alphabetically members of all grades has been followed. The total membership is 1187, segregated as follows: Honorary members, 3; members, 996; associate members, 43; associates, 30; juniors, 90; student juniors, 25. A list of places where the proceedings may be found discloses that there are 46 foreign societies, libraries or institutions and 125 smaller organizations in the United States keeping files.

PERSONAL NOTES

P. TREVINO, consulting engineer for the Leon Springs, Tex., training camp for officers, has been appointed also chief engineer of the Waco, Tex., sewage disposal plant. Mr. Treviño is a native of the City of Mexico, and was graduated from the National Engineering School of Mexico in 1895. He was formerly chief engineer of the National Railroads of Mexico, and has designed and built various sewage disposal plants in Texas.

H. B. VOORHEES has been appointed general superintendent of transportation of the Baltimore & Ohio with headquarters at Baltimore. Graduating from Rensselaer Polytechnic Institute in 1896, he began railway

work in the same year as assistant supervisor of the Philadelphia & Reading at Tamaqua, Penn. Mr. Voorhees entered the service of the Baltimore & Ohio on Dec. 1, 1901, and in August, 1902, was promoted to division engineer. In May, 1910, he became assistant to the president of the road, and on May 1, 1912, became general superintendent of the Baltimore & Ohio and the Cincinnati, Hamilton & Dayton lines.

O. SINGSTAD has resigned as designer with the Public Service Commission, First District, New York, to accept a position in the designing division of the Chile Exploration Co. He has been connected with the commission for the past 7½ years, and has had charge of the design of the East River tunnels of the William St.-East River-Clark St. line, as well as other subway sections.

J. C. HASKINS has resigned from the engineering organization of the Roberts & Schaefer Co., engineers and contractors, Chicago, to become chief engineer of the Louisville Bridge and Iron Co., Louisville, Ky. For a number of years he was in the engineering department of the Louisville & Nashville Railroad Company.

H. C. TITCOMB, maintenance-of-way assistant to the assistant chief engineer of the northern division of the Southern Pacific, at San Francisco, has been appointed superintendent of the Stockton division, with headquarters at Stockton, Calif., succeeding C. H. KETCHUM, resigned.

HAROLD ROGERS, assistant engineer and water superintendent of the Oakdale irrigation district, has resigned to accept a position with the Haviland-Tibbits Co., and will be engaged on drainage work at Marysville, Cal.

IRWIN S. OSBORNE, consulting engineer of garbage and refuse disposal, has joined the Food Administration Service at Washington, D. C., as head of the division of the Utilization of Food and Household Waste.

EARLE L. WATERMAN has returned to the Pennsylvania State College as associate professor of sanitary engineering after a leave of absence for a year and a half. He is in charge of hydraulic and sanitary work in the civil engineering department. Professor Waterman was connected formerly with the Michigan State Board of Health.

CHARLES B. WING, professor of structural engineering at Leland Stanford, Jr., University, has accepted a commission as major in the Twenty-Third Regiment of Engineers. Professor Wing was graduated from Cornell University in 1886, returning as a fellow in civil engineering in 1886-7. After serving his own university as an instructor in civil engineering he became assistant professor and professor of bridge and hydraulic engineering at the University of Wisconsin. He has held his professorship at Stanford since 1892 and has also engaged in practice, especially on structural work. Professor Wing is the author of "Manual of Bridge Drafting" (with C. H. Wright) and "Free-Hand Lettering for Working Drawings."

FRANCIS M. WARING, acting engineer of tests of the Pennsylvania R.R., at Altoona, Penn., has been appointed engineer of tests.

G. E. QUICK is superintending the construction of the Thomas Automobile Factory at Decatur, Ill., for the M. J. Hoffman Construction Co., of Evansville, Indiana.

R. J. WINDROW, recently county engineer of McLennan County, Texas, has been appointed chairman of the Texas Board of Water Engineers to succeed J. C. NAGEL, resigned.

WILLIAM H. ENNIS, after ten years of service as assistant engineer in charge of water-works and sewerage in the Pennsylvania Department of Health, has assumed the duties of superintendent of the House Sewerage Bureau of the City of Allentown, Penn. He will prepare plans of sewerage for the entire city and also plans of sewage disposal, and have charge of the construction of the work.

W. F. MONTFORT, consulting chemist, St. Louis, has been made acting professor of sanitary chemistry at the University of Illinois, vice PROF. EDWARD BARTOW, now major in the Sanitary Corps, United States Army.

R. W. HEERLEIN, contracting engineer of the Massillon Bridge and Structural Co., of Massillon, Ohio, is now also chief engineer of the company.

DR. DAVID B. STEINMAN, formerly assistant engineer in the construction of the Hell Gate Bridge, and subway construction in New York City, has been appointed associate professor of civil and mechanical engineering in the day session of the College of the City of New York. Doctor Steinman was formerly professor of engineering in the University of Idaho.

O. W. HARRAH, formerly assistant engineer, U. S. Reclamation Service, in charge of construction of storage reservoir on the Fort Peck project, Montana, is now attending the Officers' Training School for Engineers at Fort Leavenworth, Kansas.

R. S. HILL has left the U. S. Reclamation Service to become an instructor in the Engineers' Training Camp at Vancouver Barracks, Wash. He holds the rank of first lieutenant.

L. F. VAILE, formerly assistant engineer of the Matanuska district of the Alaska Government Ry., has resigned his position with the Alaska Engineering Commission, and is now at San Francisco.

DR. JESSE M. WORTHEN, for the past eight years superintendent of the Charleston Light and Water Co., of Charleston, S. C., has resigned and has been ordered to active duty as a captain in the Engineer Officers' Reserve Corps, being stationed at Belvoir, Virginia.

J. J. TURNER has been elected president of the Grand Rapids & Indiana Ry. Co. to succeed J. H. P. HUGHART, deceased.

F. M. EDWARDS, who has been acting engineer, has been promoted to city engineer of Jacksonville, Fla., and J. H. HALLETT, chief clerk of the engineering department, has been promoted to assistant city engineer.

F. N. MENEFEE has left the employ of the Fargo Engineering Co., Jackson, Mich., to enter the army in the inspection section, Gun Division, Ordnance Department, with a commission as captain, Officers' Reserve Corps.

HOBART D. SHAW has been appointed engineer of the Drainage Commission of Harrison County, Alabama.

W. C. HAMMATT, San Francisco, has been appointed engineer for the Medford Irrigation district, Jackson County, Oregon. The district is approximately 20,000 acres in extent.

W. S. WOLFE has returned from Detroit to the University of Illinois as instructor in architectural engineering, and is teaching advanced structural work to juniors and seniors.

CARL F. HEINTZE has resigned his position as assistant highway engineer, Sacramento County Highway Commission, California, and is now first lieutenant in the Engineers' Training Camp, at Vancouver Barracks, Washington.

J. P. KEMMERER, deputy county surveyor, San Bernardino County, California, has been made acting county surveyor during the furlough granted J. S. SOURWINE, county engineer, who has received a captain's commission in the Engineer Officers' Reserve Corps. Captain Sourwine has been ordered to the training camp at Fort Leavenworth.

C. F. HEALEY, general manager of the United Engineering Co., Chicago, has been commissioned captain in the Corps of Engineers, U. S. R., and has been ordered to Ft. Leavenworth, Kan., for study at the Army Service School.

HERMAN C. ALLEN, of Wallace, Idaho, has been appointed state highway engineer in place of E. M. BOOTH, resigned to enter Federal Service.

JOHN F. RYAN, formerly general superintendent of the J. J. O'Brien Construction Co., New York City, and CHARLES H. PRESTON, JR., consulting engineer of Waterbury, Conn., have formed a partnership under the firm name of Ryan and Preston, and will undertake general contract work, having already received a large railroad contract. Mr. Preston will

continue his private practice of consulting engineer with an office in Waterbury.

S. A. JUBB, former harbor engineer for the City of Los Angeles, has been appointed supervising engineer of the new naval base to be established at Hunters' Point, San Francisco.

G. H. NICKERSON, formerly in the employ of the Yosemite Ry. at Merced, Calif., and formerly connected with the Santa Fé Ry., has been named as the new engineer of the Oakdale Irrigation District, California.

RICHARD K. MEADE, consulting chemical and industrial engineer, Baltimore, Md., announces that he has formed a partnership with HOWARD T. TOMPKINS, under the name of Richard K. Meade & Company.

CAPT. GEORGE E. MARTIN, for the past three years professor of Highway Engineering at Purdue University, is now in active service in the Engineer Corps, U. S. A.

J. M. OATES, superintendent for the Atlantic Bitulithic Co., Richmond, Va., who has been in charge of contracts in Harrison County, West Virginia, has been transferred to Newport News to take charge of a new contract.

Among the officers of the 109th Engineers at Camp Deming, N. M., are LIEUT. COL. P. F. WALKER, dean of engineering, Iowa State College; CAPT. T. R. AGG, professor of highway engineering, Iowa State College; and CAPT. WILBUR M. WILSON, supply officer, professor of structural engineering, University of Illinois.

B. W. SEARS, assistant engineer with the Coast Bridge Co., of Portland, Ore., and son of GEORGE A. SEARS, vice president of the company, is now corporal with Company E, 18th (Railway) Engineers "somewhere in France."

H. BAYARD FRIEDMAN, recently in charge of construction at the Chevrolet plant at Tarrytown, N. Y., for the W. E. Wood Co., Detroit, is now at the Reserve Officers' Training Camp, Leon Springs, Texas.

GEORGE E. MCINTYRE, who has been structural engineer of Smith, Rea and Lovitt, architects, Kansas City, Mo., has been commissioned first lieutenant in the Engineer Officers' Reserve Corps.

H. F. WALDER, Kewanee, Ill., is now resident engineer on the Cambridge Road, Henry County, Illinois.

BRADLEY W. BARTHOLOMEW, engineer of construction, Flynt Building and Construction Co., Palmer, Mass., has been commissioned second lieutenant, Engineer Officers' Reserve Corps.

EDWARD R. SMITH, formerly junior engineer, U. S. Reclamation Service, on Belle Fourche Irrigation Project at Newell, S. D., is now a member of the engineering staff of the Southern Power Co., Charlotte, North Carolina.

GEORGE W. SNYDER, principal assistant engineer, western Pennsylvania division of the Pennsylvania R.R., has been appointed assistant engineer, maintenance-of-way, vice G. C. KOONS. Mr. Snyder entered the service of the Pennsylvania in 1884 as rodman. In 1907 he became principal assistant engineer of the western Pennsylvania division.

W. T. COVERT, division engineer of the Philadelphia terminal division of the Pennsylvania R.R., has been promoted to principal assistant engineer of the western Pennsylvania division, with office at Pittsburgh, succeeding GEORGE W. SNYDER.

C. E. BRINSER, division engineer of the Pennsylvania Ry. at Altoona, has been made division engineer at Philadelphia; his place at Altoona is taken by A. W. MCCLELLAN, formerly division engineer at Williamsport, who is succeeded by ROBERT C. FARIES, division engineer at Elmira, New York.

C. M. WISMAN, supervisor of the New York division of the Pennsylvania R.R. at Trenton, N. J., has been promoted to division engineer of the Elmira division.

J. C. HACKENBERG, division engineer of the Pennsylvania R.R. at Oil City, Penn., has been promoted to division engineer at Wilmington, Del., succeeding J. R. MCGRAW on leave of absence.

GEORGE G. SCHMIDT, formerly engineer for the Metropolitan Street Railway Co., and at various times engineer for the Pennsylvania R.R., the Belmont tunnels and the Ashokan dam, and who has also been engaged in the erection of industrial plants, is now with the Carrier Engineering Corporation.

JAMES F. TABLER, formerly connected with the Southern Ry. system, Lines West, as assistant engineer at Cincinnati, Ohio, has been appointed civil engineer and superintendent of construction with the Quartermaster Corps, U. S. A., at Boston.

VINTON D. COCKEY, of Morse, Paul & Cockey, consulting engineers, Baltimore, and formerly in charge of the division of surveys and construction, Maryland State Department of Health, was recently commissioned captain in the Engineer Officers' Reserve Corps, and has been assigned to the 305th Pioneer Regiment.

HENRY M. LOVERING has resigned the office of water commissioner of Taunton, Mass., on account of ill health. Mr. Lovering was elected a water commissioner in 1880, succeeding Marcus M. Rhodes, one of the original water commissioners. Elected president of the commissioners in 1894, to succeed Parley I. Perrin, his services have been continuous until this time. Upon Mr. Lovering's resignation, the Municipal Council of Taunton passed resolutions of regret, and acknowledged the city's obligation to Mr. Lovering for his services.

OBITUARY

WILLIAM S. JOHNSON, consulting engineer, Boston, died Nov. 27. He was born in 1867 and was graduated from Massachusetts Institute of Technology in 1889. After some preliminary work with the Massachusetts State Board of Health and the City of Brockton, he went to Brooklyn, N. Y., as sanitary engineer, Department of Health. He then became assistant engineer of the Massachusetts State Board of Health. In 1907 he opened an office in Boston as consulting engineer, and since that time was connected with many engineering projects in New England, particularly in Massachusetts. His last work was in charge of the water-supply at the army cantonment, Camp Devens, Ayer, Mass. Mr. Johnson took a prominent part in the affairs of the Boston Society of Civil Engineers and was chairman of the Sanitary Section in 1908, treasurer of the society in 1906 and vice president from 1912 to 1914. He was also active in the affairs of the New England Water-Works Association.

A. T. HERRMANN, who at one time was surveyor of Santa Clara County, California, died at San Jose, Calif., Oct. 23, at the age of 79.

ALBERT BRAYSHAW, civil engineer in the employ of the British War Department, died Nov. 5 in Brooklyn, New York.

WILLIAM SINCLAIR BACOT, president of the Consolidated Water Co., of Utica, N. Y., died on Nov. 1.

ISAAC S. TAYLOR, architect, who was director of works for the Louisiana Purchase Exposition, and the designer of more than twenty of St. Louis' largest buildings, died in St. Louis, Oct. 28.

ERNEST BELANGER, Montreal, died Oct. 21. He was a member of the commission which visited a number of countries in Europe to obtain information for the government of the Dominion of Canada on technical education. He was 54 years of age.

JOHN D. CRIMMINS, retired contractor of New York City, died at his home in New York, Nov. 9. He was in his 74th year. Mr. Crimmins was identified with many of the greatest public works of the city, such as the putting underground of the telephone and telegraph wires, the building of the Broadway-Columbus Ave.-Lexington Ave. cable line and the later conversion of the line into an electrical

system operated by means of underground wires. He also built part of the elevated railroads and was the contractor for the Fourth Ave. improvement across the Harlem Valley. Mr. Crimmins was one of the first contractors to use the steam drill in making underground excavations. In many years of constructing railways, laying out parks and streets and erecting large buildings he built up one of the great contracting businesses of America, and was said to have 20,000 men on his payrolls at one time.

Notes from

MAKERS OF PLANT AND EQUIPMENT

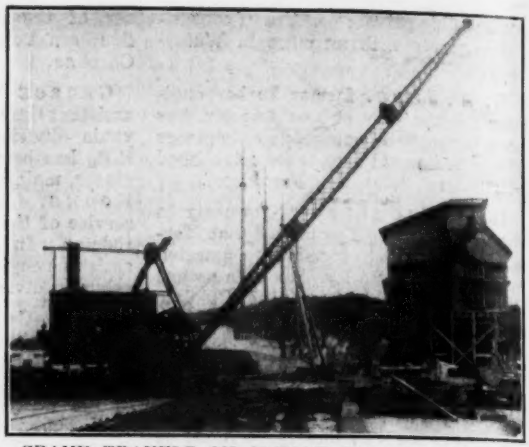
Greene-Wolf Co., Inc., Hudson Terminal Building, New York City, announces that it is organized to conduct a general business in iron and steel products, including wrought iron and steel pipe, tubular goods and structural shapes.

Davis-Bournonville Co., Jersey City, has recently opened a government sales office in the Colorado Building, Washington, D. C., with Henry R. Swartley, Jr., resident manager. The company manufactures oxy-acetylene welding and cutting apparatus and oxygen and hydrogen producing apparatus, which is being used extensively by both the army and the navy.

King Trailer Co., Ann Arbor, Mich., is claiming a construction record for its new factory. The contract was let to the Austin Co., of Jackson, Mich., on June 25, and five days later construction work commenced. By July 25 the factory was occupied and the company mechanics were hard at work turning out trailers. The new building, 60 x 160 ft. in plan, is of brick, steel and concrete.

Oxford Truck Manufacturing Co., Newark, N. J., has been incorporated to manufacture all kinds of trucks and vehicles; the capitalization is $125,000. The incorporators are John J. Bush, New York, and George W. Nuse, Newark.

Federal Export Corporation has sent Dwight S. Guthrie, Guy L. Bayley and Burtin Honig from Vancouver to Yokohama, where the company's temporary oriental headquarters will be established. Mr. Guthrie, as vice president of the corporation, has had charge of the iron and steel department since its formation. He was formerly associated with the Republic Iron and Steel Co. as district sales manager in St. Louis, Birmingham, Cleveland and Chicago. Mr. Guthrie's duties at the headquarters office, during his absence, will be performed by Samuel Denner, recently elected a vice president of the Federal Export Corporation. Mr. Bayley was chief electrical and mechanical engineer for the Panama-Pacific International Exposition, and has seen service in Japan as resident consulting engineer on mines, railroads and industrial concerns. Mr. Honig, who will have charge of the Oriental mercantile department of the Federal corporation, has spent the past seventeen years selling American products in India, Japan, China, Java and Australia.



CRANE TRAVELS ON 20-FOOT GAGE STANDARD TRACKS AND HANDLES 3 TONS COAL PER LOAD

APPLIANCES AND MATERIALS

New Traveling Crane Handles Coal on Terminal Pier

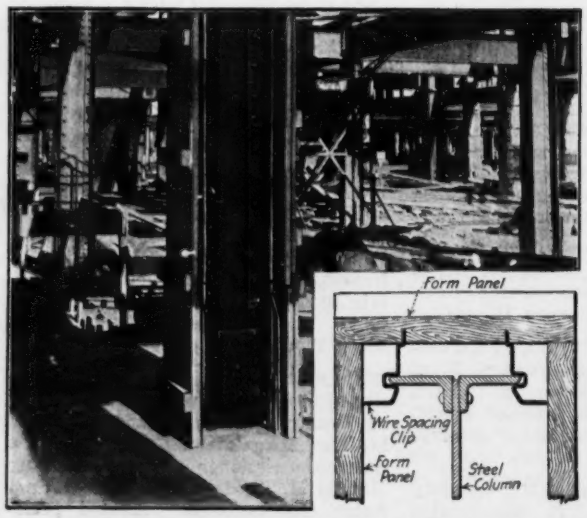
The traveling crane shown in the accompanying view was built by the Orton & Steinbrenner Co., of Chicago, for the new municipal port of Astoria, Ore. The machine travels upon two standard-gage tracks spaced 20 ft. c. to c. It is required to pass around a track with radius of 100 ft. at the end of the dock. This is provided for by equalizing gears on each of the transverse shafts of the car body driving by means of spur pinions, into curved face spur gears on the axles of the trucks.

The car body is supported at each corner by a 100,000-lb. standard truck. The boom is 100 ft. long and handles a 4-cu.yd. clamshell bucket in coal, thus taking 3 tons of coal at a trip. The boiler is a 76-in. diameter vertical tubular with heating surface of 900 sq.ft. The engines are 10 x 10 in. All operations are handled on double gear clutches.

The opening or hold line of the bucket is handled on a drum which is overhauled automatically by a counterweight at the rear end of the cab. The hoist framing, drums and sheaves of this machine are of cast steel and all bearings are bronze bushed.

Clips Hold Forms for Concrete

Form clips acting both as spacers and attachments facilitate casing the steel framework of the new Chicago freight station of the Pennsylvania Lines. The clips are of heavy wire, bent to shape as shown. Before placing the forms, clips are driven in two of the side panels, the bend giving the proper depth. As the panels are erected on the columns the clips are sprung over the flanges, holding the panel in place and at the proper distance. The other side panels engage the longer projecting ends of the clips and hold them in position. The clips remain in place, helping to anchor the concrete to the steel. The only parts projecting are the short ends driven into the forms, and these are readily cut off. The device is made by the American Concrete Equipment Co., 2958 Prairie Ave., Chicago, and has been long enough on the market to have demonstrated its value as an aid in this form of construction.



SIDE FORMS HELD BY WIRE SPACING CLIPS